ENVIRONMENTAL STRATEGIES CORPORATION
Four Penn Center West Suite 315 Pittsburgh Pennsylvania 15276 (412) 787 5100 Fax (412) 787-8065

1998 INTERIM GROUNDWATER MONITORING REPORT

BUCKEYE RECLAMATION LANDFILL
BELMONT COUNTY, OHIO

PREPARED

BY

ENVIRONMENTAL STRATEGIES CORPORATION

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Executive Summary

The purpose of interim groundwater monitoring for the Buckeye Reclamation Landfill (BRL) was to collect annual water levels and groundwater quality samples from piezometers and monitoring wells installed in the southern toe area as part of the long term monitoring effort During June 1998 groundwater quality samples and water level measurements were collected from four piezometers screened in the unconsolidated material water-bearing horizon one monitoring well in the Benwood Limestone Formation and three monitoring wells installed in the Redstone Limestone Formation The water level was measured in one piezometer installed east of Kings Run

Water level data were used to determine groundwater elevations for the unconsolidated material and Redstone Limestone water-bearing horizons Groundwater flow in the unconsolidated material horizon at the southern toe converges toward seep L 4 Groundwater in the unconsolidated material located west of seep L-4 migrates eastward toward the former Kings Run valley Groundwater elevations in the Redstone Limestone monitoring wells indicate that groundwater in the Redstone Limestone at the southern toe of the BRL migrates toward the south-southeast A groundwater flow direction for the Benwood Limestone was not determined because only one monitoring well installed in this horizon was measured

The collected groundwater quality samples were analyzed for volatile organic compounds (VOCs) bis-(2 ethylhexyl)phthalate (B2EHP)) polycyclic aromatic hydrocarbons (PAHs) total and dissolved metals, alkalinity ammonia nitrogen chemical oxygen demand (COD) chloride, nitrate and nitrite-nitrogen sulfate, total dissolved solids (TDS) pH specific conductance and turbidity in accordance with the U S Environmental Protection Agency (EPA) approved interim groundwater monitoring plan

Four groundwater quality samples and a duplicate sample were collected from piezometers completed in the unconsolidated material horizon at the southern toe of the BRL The laboratory data indicate that no B2EHP or PAHs were detected above Maximum Contaminant Levels (MCLs) Acetone was detected in P-4 above the quantitation limit of the analytical method, at a concentration of 41 micrograms per liter (µg/l) Methylene chloride was detected in P-1B P-2 and P-4 at concentrations ranging from 9 µg/l to 19 µg/l

Nickel concentrations were reported above applicable MCLs in three of the four groundwater quality samples collected from the unconsolidated material The beryllium concentrations in P-1B the lead concentrations in P 22 and the duplicate samples and arsenic in MW-60 exceed their respective MCLs The reported thallium concentrations in P-1B P-4 P-22 and MW-60 exceed their MCL However the reported thallium concentrations in all four were qualified as estimated concentrations after quality assurance/quality control (QA/QC) review Reported concentrations of iron manganese sulfate total dissolved solids (TDS), and turbidity in all five water quality samples collected from the unconsolidated material piezometers exceed secondary maximum contaminant levels (SMCLs)

The general absence of organic analytes indicates that the unconsolidated material water-bearing horizon at the southern toe is not affected by organic materials disposed of at the site Inorganic parameters analyzed suggest that landfill leachate may be marginally affecting the groundwater in this water-bearing horizon In addition several inorganic constituents indicate that the unconsolidated horizon is probably affected by acid mine drainage (AMD)

One groundwater quality sample was collected from monitoring well MW-11B completed in the Benwood Limestone Formation The laboratory data indicate that no VOCs B2EHP or PAHs were detected above MCLs A concentration of methylene chloride was reported in the sample above the MCL but was qualified as probable blank contamination after completion of the QA/QC review The concentration of thallium in the Benwood Limestone water quality sample exceeds its MCL but was qualified as an estimated concentration after the completion of the QA/QC review No other reported metal concentrations exceed MCLs Reported concentrations of sulfate TDS turbidity and the estimated concentrations of iron and manganese in the water sample exceed SMCLs The chloride concentration suggests that landfill leachate may be marginally influencing water quality in the Benwood Limestone water-bearing horizon The concentrations of iron sulfate manganese and TDS suggest that the groundwater in the Benwood Limestone may be affected by acid mine drainage

Three groundwater quality samples were collected from monitoring wells completed in the Redstone Limestone horizon at the southern toe of the BRL The laboratory data indicate that one VOC was detected above quantitation limits and was qualified as probable blank contamination after completion of the QA/QC review Estimated concentrations of B2EHP were detected above its quantitation limit but below its MCL in two water quality samples collected

from the Redstone Limestone wells Concentrations of lead in MW-17C and thallium in MW-15C MW 16C and MW-17C exceed their respective MCLs After completion of the QA/QC review the thallium concentrations were qualified as being estimated concentrations Sulfate TDS and turbidity concentrations and the reported estimated concentrations of iron and manganese in all three of the water quality samples exceed their SMCLs Chloride concentrations suggest that landfill leachate may be marginally influencing water quality in the Redstone Limestone water-bearing horizon The concentrations of sulfate manganese iron and TDS suggest that the groundwater in the Redstone Limestone may be affected by acid mine drainage

In conclusion water quality data from piezometers and monitoring wells at the southern toe of the BRL indicate that landfill leachate may be marginally affecting water quality in the unconsolidated material Benwood Limestone and Redstone Limestone horizons Groundwater quality in the unconsolidated material west of seep L-4 the Benwood Limestone and the Redstone Limestone horizons appears to be affected by acid mine drainage No background water quality data are available for comparison

1 0 Introduction

This report documents the results of the 1998 interim groundwater monitoring conducted at the Buckeye Reclamation Landfill (BRL) The work was conducted in accordance with the interim groundwater monitoring plan presented in the April 22 1997 correspondence from George Gleich BRL Project Coordinator to the U S Environmental Protection Agency (EPA) The interim groundwater monitoring plan was approved by the EPA and the Ohio EPA by letter dated April 23 1997 The field activities were conducted in accordance with the scope of work presented in the June 10 1997 proposal from Environmental Strategies Corporation (ESC) to George Gleich and subsequently submitted to the EPA on June 12 1997 The EPA and Ohio EPA approved ESC's proposal by correspondence dated July 15 1997 The protocols used during the interim groundwater monitoring activities were the same as those in the EPA-approved RD Work Plan (October 15 1992) for the Supplemental Hydrogeologic Study

1 1 Scope and Purpose of Study

The purpose of the interim groundwater monitoring is to collect annual groundwater quality samples and measure groundwater levels from piezometers and monitoring wells installed in the vicinity of the southern toe at the BRL Groundwater quality samples and water levels were collected from piezometers P-1B P-2 P-4 and P-22 installed in the unconsolidated material monitoring well MW-11B completed in the Benwood Limestone and monitoring wells MW-15C MW-16C and MW-17C installed in the Redstone Limestone In addition a water level measurement was collected for piezometer P-13 which was completed in the unconsolidated material east of Kings Run

The collected groundwater quality samples were analyzed for the constituents described on Table 2 of the EPA approved April 22, 1997 Ground Water Monitoring Plan Summary The EPA approved Groundwater Monitoring Plan Summary was included in Appendix A in the 1997 Interim Groundwater Monitoring Report and will not be duplicated in this report Water quality analyses were performed by Ceimic Corporation an EPA Contract Laboratory Program (CLP) member Ceimic is also certified to perform Ohio sanitary landfill analyses

The water level data were used to construct groundwater contour maps and to determine groundwater flow directions in the unconsolidated material and the Redstone Limestone water-bearing horizons in the vicinity of the southern toe at the BRL

1 2 Interim Groundwater Monitoring

The results of the interim groundwater monitoring conducted during June 1998 are presented in this report in accordance with the approved scope of work ESC collected groundwater quality samples and measured water levels in five piezometers and three monitoring wells between June 22 and 24 1998

This report provides a summary and evaluation of the hydrogeologic (i e water levels and groundwater flow directions) and analytical (i e groundwater quality) data collected during the 1998 interim groundwater monitoring activities Groundwater contour maps for the unconsolidated material and the Redstone Limestone in the vicinity of the southern toe are presented based on water level data collected during June 1998

1 3 Site Location and Description

The BRL site is part of a 658-acre tract of land located off State Route 214 approximately 4 miles southeast of St Clairsville and 1 2 miles south of Interstate 70 in sections 20 and 21 (Township 6 North Range 3 West) Richland Township Belmont County, Ohio (Figure 1-1) Interstate 470 is located just south of the landfill access roadway and approximately 3 000 feet north of the landfill area The BRL site is situated on the western side of the Kings Run drainage ravine it is bordered by Kings Run to the east and Unnamed Run to the west Kings Run flows to the south and empties into Little McMahon Creek west of the village of Neffs Ohio The BRL landfill extends approximately 3 700 feet north to south and is approximately 500 to 1 000 feet in width The BRL site occupies approximately 100 acres of the 658-acre tract of land

Property adjacent to the east and west is hilly and mostly forested West of the site and Unnamed Run is Ebbert Road Along this road are farms and farther west a surface mine operation To the south the land is forested along the steeper slopes and cleared for residential development along the local stream valleys and roadways There is additional farmland north and northeast of the BRL

The original topography of the valley of Kings Run and the ridge to the west has been altered by mine refuse disposal and landfill operations Underground mining activities occurred beneath portions of and adjacent to the 658-acre property until approximately 1940 Until about 1950 the site was a disposal area for mine refuse Mine refuse from the processed coal was disposed of on the ridge west of Kings Run and in the Kings Run drainage ravine The BRL area was licensed as a public solid waste landfill in 1971 by the Belmont County Health Department (BCHD) and was operated until April 1991 under the name of Buckeye Reclamation Landfill or the Belmont County Landfill The BRL is located on property owned by Ohio Resources Corporation As a public landfill the facility accepted general trash rubbish and nonhazardous waste from municipalities and villages in the local Belmont County area

The BRL also accepted industrial sludges and liquid wastes These wastes were received between 1976 and 1979 and deposited in or near the identified waste pit The waste pit was a small impoundment located in the northern section of the landfill area

In the early 1980 s the U S EPA and Ohio EPA conducted preliminary investigations to determine whether potential risks were posed by the BRL to public health and environment The BRL site was placed on the National Priorities List (NPL) in October 1984 Since then numerous studies have been conducted to characterize site conditions

1 4 Remaining Sections of Report

The following sections of this 1998 Interim Groundwater Monitoring Report include 2 0 Hydrogeologic Methods 3 0 Hydrogeologic Investigation Results 4 0 Groundwater Sampling Procedures and Results, 5 0 Conclusions and 6 0 References All tables figures and appendices are included with this report

2 0 Hydrogeologic Methods

On June 22 1998 groundwater quality samples and water levels were collected from four piezometers (P-1B P-2 P-4 and P-22) and four monitoring wells (MW-11B MW 15C MW 16C and MW-17C) installed in the vicinity of the southern toe area A water level was also collected from one additional piezometer (P-13) located east of Kings Run The locations of the interim groundwater monitoring piezometers and monitoring wells are presented on Figure 2-1 The piezometers and monitoring wells from which water quality samples or water levels were collected were re-surveyed by a registered and licensed Ohio surveyor for vertical elevations during October 1997 The methods used to conduct the 1998 interim groundwater monitoring were the same as those used during the Supplemental Hydrogeologic Study (1992) the Additional Hydrogeologic Investigation (1993) and the Southern Toe Hydrogeologic Investigation (1996) as approved by the EPA Pertinent monitoring well and piezometer construction data such as reference elevations screened interval total depth and the monitoring interval are presented in Table 2-1

Piezometers P-1B P-2 P-4 and P-13 were installed in the unconsolidated material by ESC during the 1992 Supplemental Hydrogeologic Study Monitoring wells MW-15C MW-16C and MW-17C were completed in the Redstone Limestone Formation by ESC during the Southern Toe Hydrogeologic Investigation (1996) ESC also installed piezometer P-22 in the unconsolidated material at the southern toe during the Southern Toe Hydrogeologic Investigation The Benwood Limestone Formation monitoring well (MW-11B) was installed during the Remedial Investigation/Feasibility Study (RI/FS) hydrogeologic investigations

2 1 Decontamination Procedures and Investigation Derived Waste Handling

Rinsewater generated during the equipment decontamination process was collected in a 5-gallon bucket and transported to an onsite tank for temporary storage pending characterization and subsequent disposal All purge water removed from the piezometers and monitoring wells before collection of the groundwater quality samples was transported from the wellhead area and placed in the onsite storage tank All personal protective equipment (PPE) used during the interim groundwater monitoring field activities was placed in a metal drum and labeled The

onsite water storage tank and the PPE drum remain onsite and are located near the waste pit area as in previous investigations

3 0 Hydrogeologic Investigation Results

3 1 Results of Groundwater Level Measurements

Water levels measured in the piezometers and monitoring wells on June 22 1998 are presented in Table 3-1 In general the 1998 measured groundwater levels increased in the unconsolidated material piezometers and the Benwood and Redstone Limestone monitoring wells from groundwater levels measured on September 22 1997 during performance of the 1997 interim groundwater monitoring activities

3 2 Hydrogeology of Southern Toe Area

3 2 1 Unconsolidated Material

Groundwater elevations recorded during the June 1998 interim groundwater monitoring for the unconsolidated material range from a minimum of 843 13 feet mean sea level (MSL) in P-1B to a maximum of 951 70 feet in P-13 (Table 3-1) The inferred groundwater contours for the unconsolidated material based on the June 1998 data are shown on Figure 3-1 The water level data indicate that groundwater flow through the unconsolidated material migrates toward the seep L-4 discharge point and the former Kings Run channel

3 2 2 Benwood Limestone

The groundwater elevation recorded during June 1998 for the Benwood Limestone (MW-11B) was determined to be 917 42 feet MSL (Table 3-1) and is presented on Figure 3-2 Groundwater elevation contours for the Benwood Limestone Formation were not developed because only one groundwater elevation from the formation was collected during the interim groundwater monitoring activities

3 2 3 Redstone Limestone

Groundwater elevations and top of PVC casing reference elevations and depth to water measurements from monitoring wells MW-15C, MW-16C and MW-17C are presented in Table 3 1 Groundwater elevations recorded during June 1998 ranged from a minimum of 801 17 feet MSL in MW-17C to a maximum of 812 89 feet MSL in MW-15C The inferred groundwater elevation contours for the Redstone Limestone Formation in the vicinity of the southern toe based on the June 1998 data are shown on Figure 3-3

Factors which may influence the direction of groundwater flow in the Redstone Limestone include the presence or absence of fractures bedding planes fracture density conduit porosity and hydraulic conductivity Because of these factors the direction of groundwater flow in any specific bedrock horizon may be locally different than that depicted on a groundwater contour map

4 0 Groundwater Sampling Procedures and Results

4 1 Sampling Locations and Parameters

Groundwater quality samples from four piezometers and four monitoring wells (Figure 2-1) were collected on June 23 and 24 1998 in accordance with the EPA-approved interim groundwater monitoring plan

Before sampling was initiated at each piezometer or monitoring well ESC inspected the monitoring well or piezometer to be sampled and measured the depth to water and total depth with an electronic water level indicator The probe and the tape of the water level indicator were decontaminated with deionized water after each use Each piezometer or well was monitored when first opened with a photoionization detector (PID) equipped with an 11 7 eV lamp to measure for the presence of organic vapors No organic vapor concentrations above ambient background levels were detected from six (P1-B P-2 P-22 MW-11B MW 15C and MW-17C) of the monitoring wells or piezometers Minor organic vapor concentrations were detected in piezometer P-4 at 9 parts per million (ppm) and at monitoring well MW-17C at 1 5 ppm

The collected groundwater quality samples were analyzed using CLP protocols U S EPA SW 846 methods and quality assurance/quality control (QA/QC) procedures The collected groundwater quality samples were analyzed by Ceimic for the constituents listed in Table 2 of the Groundwater Monitoring Plan Summary The constituent list includes volatile organic compounds (VOCs) polycyclic aromatic hydrocarbons (PAHs) and the semi-volatile compound (SVOC) bis-(2-ethylhexyl)phthalate (B2EHP) total and dissolved metals and the inorganic parameters alkalinity, ammonia nitrogen chemical oxygen demand (COD) chloride nitrate and nitrite nitrogen pH specific conductance sulfate total dissolved solids (TDS) and turbidity in accordance with Ohio EPA Solid Waste Regulations 3745 27-10 and regulatory agency requests The VOCs PAHs and B2EHP constituents were analyzed by U S EPA CLP Statement of Work (SOW) for Organics OLM01 9 The metals were analyzed by EPA CLP SOW for inorganics ILM03 0 The inorganic parameters were analyzed by EPA Methods SM 2320B 350 1 410 4 9056 9056 9056 150 1 120 1, 9056 160 1 and 180 1 respectively

Sample containers for VOCs total and dissolved metals ammonia and COD were received from the laboratory with the appropriate preservative All sample coolers were

maintained at 4 degrees C and transported to the analytical laboratory by an overnight delivery service In addition to the laboratory analysis listed above the groundwater samples were analyzed in the field for the following parameters

- temperature
- pH
- specific conductance
- turbidity
- total alkalinity

4 2 Sampling Procedures

After recording the depth to water and total depth of each monitoring well or piezometer the purge volume necessary to remove three well volumes was calculated All purge water was placed in plastic 5-gallon containers transported from the wellhead and placed in the onsite temporary storage tank

The piezometers and monitoring wells were purged using dedicated polyvinyl chloride (PVC) bailers New and unused nylon rope was attached to the bailer when purging and dedicated to either the piezometer or monitoring well for sample collection The volume of groundwater purged from each piezometer or monitoring well was recorded on groundwater monitoring data log forms Field measurements of temperature pH specific conductance and turbidity were recorded from the prepurge beginning midpoint and final volumes of the purge process to ensure that these parameters stabilized before groundwater quality samples were collected In addition total alkalinity measurements were recorded from the final purge volume The field parameter measurements were recorded on groundwater monitoring data log forms and are included as Appendix A A Horiba U-10 water quality meter was used to measure pH temperature specific conductance and turbidity A Hach Model AL-AP MG-L alkalinity field test kit was used for determining the total alkalinity The field measurements collected from the final purge volume are presented in Table 4-1

After the monitoring well or piezometer was purged groundwater quality samples for laboratory analysis were collected with a new dedicated Teflon bailer VOC samples were collected within 2 hours of purging the monitoring well or piezometer in accordance with the

agency approved RD Work Plan protocols Groundwater quality samples collected for total and dissolved metal analysis were filtered in the field using a Masterflex pump Teflon tubing and 0 45-micron filters The collected groundwater quality samples were packed in iced coolers and forwarded via overnight delivery to the analytical laboratory

4 3 Sampling Results

The analytical results for the groundwater quality samples collected during the 1998 interim groundwater monitoring are presented in Tables 4-2 4-3, and 4 4 by water-bearing horizon These tables summarize the results that were detected above the quantitation limit of the analytical method or estimated concentrations below the quantitation limits A separate table with results for all of the parameters analyzed and the detection limits for each constituent is presented in Appendix B The QA/QC report prepared after reviewing the analytical data is presented in Appendix C The raw analytical data provided by the laboratory are available upon request A discussion of the sampling results for each water-bearing unit is presented in the following sections

4 3 1 Unconsolidated Material

The analytical results for the groundwater quality samples collected from the four piezometers screened in the unconsolidated water-bearing horizon are presented in Table 4-2 Groundwater quality sample MW-60 was a duplicate sample collected from P-22 for QA/QC protocols

VOCs were detected in the groundwater quality samples collected from the unconsolidated material piezometers above quantitation limits of the analytical method Methylene chloride was present in P 1B P-2 and P-4 in levels ranging from 7 µg/l to 19 µg/l acetone was present in P-4 at 41 µg/l

No PAHs were detected above the quantitation limit of the analytical method in the four water quality samples collected from the unconsolidated material water-bearing horizon

Total arsenic beryllium calcium chromium cobalt lead magnesium manganese nickel potassium and vanadium were detected above the quantitation limit of the analytical methods in the groundwater quality samples

Dissolved arsenic beryllium calcium cadmium cobalt iron lead magnesium manganese, nickel potassium sodium and vanadium were detected above the quantitation limit of the analytical methods in the groundwater quality samples

Of the other inorganic parameters analyzed ammonia nitrogen concentrations ranged from 0 23 mg/l in P-2 to 20 mg/l in the duplicate sample MW-60 chloride was detected in all five water samples ranging from 24 5 mg/l in MW-60 to 203 mg/l in P-4 sulfate concentrations ranged from 1 300 mg/l in P-2 to 3 960 mg/l in P-1B and reported pH values for the unconsolidated material water quality samples ranged from 3 56 in P-1B to 6 43 in P-4

The reported methylene chloride concentrations in all the water quality samples and the duplicate sample collected from the unconsolidated material piezometers exceed or equal the MCL However the reported methylene chloride concentrations in P-22 and the duplicate sample (MW-60) were qualified as probable blank contamination after QA/QC review In addition total nickel and estimated thallium concentrations reported from groundwater quality samples collected from piezometers P-1B P 4 and P 22 and the duplicate sample MW-60 exceed MCLs Beryllium concentrations in P 1B lead concentrations in P-22 and the duplicate sample and the arsenic concentration in the duplicate sample also exceed MCLs

The reported sulfate TDS and turbidity concentrations in all five water quality samples collected from the unconsolidated material piezometers exceed SMCLs

Field measurements were recorded during the interim groundwater monitoring sampling event for pH temperature specific conductance total alkalinity and turbidity These results are presented in Table 4-1

4 3 1 1 Evaluation of the Unconsolidated Material Sampling Results

Groundwater sampling results are provided in Table 4-2 Constituents in the unconsolidated material water-bearing horizon that exceed MCLs are presented on Figure 4-1

- Two VOCs (methylene chloride and acetone) were detected above the quantitation limit of the analytical methods
- Methylene chloride was detected above MCLs
- B2EHP and PAHs were not detected

- Total nickel and estimated concentrations of thallium in piezometers P-1B, P-4 P-22 and the duplicate sample MW-60 exceed MCLs Beryllium concentrations in P-1B and lead levels in P-22 and MW-60 exceed MCLs Arsenic concentrations in MW-60 exceed the MCL

- Estimated iron concentrations in all four piezometers and the duplicate sample exceed the secondary maximum contaminant level (SMCL) of 0 3 mg/l

- Reported and estimated concentrations of manganese in all four piezometers and the duplicate sample exceed the SMCL of 0 05 mg/l

- Reported estimated concentrations of zinc in piezometers P-1B and P-22 and the duplicate sample (MW-60) exceed the SMCL of 0 5 mg/l

- Chloride in P-4 was near the SMCL of 250 mg/l which indicates that solid waste disposal may be affecting the water quality at this location

- The low chloride concentrations in piezometers P-1B P-2 and P 22 suggest that these areas may be marginally affected by landfill leachate

- Nitrate and nitrite nitrogen concentrations were reported as not detected in the water quality samples and suggests that this area is not affected by landfill leachate

- The sulfate and TDS concentrations in all four unconsolidated material piezometers exceed their respective SMCLs of 250 mg/l and 500 mg/l

- Nondetectable concentrations of alkalinity, low pH values and elevated iron manganese sulfate and TDS concentrations suggest that P-1B and P-22 are being affected by acid mine drainage (AMD)

- The SMCL for turbidity (1 0 NTU) was exceeded in every piezometer sampled during the 1998 interim groundwater monitoring activities

- The general absence of organic analytes above quantitation limits suggests that the southern toe area of the BRL is not affected by organic materials disposed of in the former waste pit area

4 3 2 Benwood Limestone

The analytical results for the one groundwater monitoring well installed in the Benwood Limestone Formation (MW-11B) sampled during the 1998 interim groundwater monitoring are presented in Table 4-3

No VOCs except methylene chloride were detected above the quantitation limit in the groundwater quality sample (MW-11B) collected from the Benwood Limestone monitoring well The estimated concentration of methylene chloride was qualified as probable blank contamination after completion of the QA/QC review

No B2EHP or PAHs were detected in the water quality sample collected from the Benwood Limestone horizon above the quantitation limit of the analytical methods

Total arsenic calcium chromium cobalt lead magnesium nickel potassium and vanadium were detected above the quantitation limits of the analytical methods in the groundwater quality samples collected from the Benwood Limestone Monitoring well

The reported estimated concentration of thallium in MW-11B (2 9 µg/l) exceeds the MCL for thallium (2 µg/l) The concentration of thallium was qualified as an estimated concentration after completion of the QA/QC review The reported estimated concentrations of iron and manganese collected from the MW-11B monitoring well exceed SMCLs The SMCLs for these metals are iron 0 3 mg/l (300 µg/l) and manganese 0 05 mg/l (50 µg/l)

Dissolved arsenic, calcium chromium iron lead magnesium manganese nickel potassium, sodium and zinc were detected above the quantitation limit of the analytical methods in the groundwater quality sample collected from the Benwood Limestone

Of the other inorganic parameters analyzed, the ammonia nitrogen concentration was reported as 0 49 mg/l, the chloride concentration was 66 4 mg/l sulfate was 972 mg/l and the reported pH value for the MW 11B sample was 6 62

The reported concentrations of sulfate (972 mg/l) and TDS (1,850 mg/l) in MW-11B exceed SMCLs The SMCLs for sulfate and TDS are 250 mg/l and 500 mg/l respectively The Benwood Limestone water quality sample exceeded the turbidity SMCL of 1 NTU

Field measurements were recorded during the groundwater quality sampling event for pH temperature specific conductance total alkalinity and turbidity These results are presented in Table 4-1

4 3 2 1 Evaluation of the Benwood Limestone Sampling Results

Groundwater sampling results are provided in Table 4-3 Constituents in the Benwood Limestone water-bearing horizon that exceed MCLs are presented on Figure 4-2

- One VOC (methylene chloride) was detected above the quantitation limit but was qualified as probable blank contamination
- No B2EHP or PAHs were detected in the water quality sample
- The concentrations of nickel and thallium in MW-11B exceed their MCLs but both were qualified as estimated concentration after QA/QC review
- Estimated iron and manganese concentrations in the Benwood Limestone water quality samples exceed SMCLs
- Nitrate and nitrite nitrogen concentrations were reported as not detected in the water quality samples suggesting that this area is not affected by landfill leachate
- The low chloride concentrations in monitoring well MW-11B suggest that this area may be marginally affected by landfill leachate
- The reported sulfate and TDS concentrations in the water quality sample exceed SMCLs
- The SMCL for turbidity (1 0 NTU) was exceeded in the water sample collected from the MW 11B monitoring well
- The absence of organic analytes above quantitation limits suggests that this area of the BRL site is not affected by organic materials disposed of in the waste pit
- The reported sulfate TDS alkalinity and estimated iron and manganese concentrations suggest that this carbonate aquifer in the vicinity of the MW-11B monitoring well may be marginally affected by acid mine drainage

4 3 3 Redstone Limestone

The analytical results for the three groundwater monitoring wells installed in the Redstone Limestone Formation (MW-15C MW-16C and MW-17C) which were sampled during the 1998 interim groundwater monitoring activities are presented in Table 4 4

No VOCs were detected in the three Redstone Limestone water quality samples above the quantitation limit of the analytical methods Methylene chloride was detected in the water quality samples from MW-16C and MW-17C above quantitation limits of the analytical methods but the results were qualified as probable blank contamination after completion of the QA/QC review

Estimated concentrations of B2EHP were detected in the water quality samples collected from the MW-16C and MW-17C monitoring wells

No PAHs were detected in the groundwater quality samples collected from the Redstone Limestone water-bearing horizon above the quantitation limit of the analytical methods

Concentrations of total arsenic calcium chromium lead potassium and selenium were detected above the quantitation limit of the analytical methods in the collected groundwater quality samples

Total barium beryllium copper iron magnesium manganese nickel cobalt sodium thallium vanadium and zinc were detected in at least one Redstone Limestone water quality sample at estimated concentrations above the quantitation limit or were qualified as estimated after completion of the QA/QC review

The concentration of lead (25 4 µg/l) in MW-17C exceeds the MCL The estimated thallium concentrations in MW-15C (3 7 µg/l) MW-16C (3 3 µg/l) and MW-17C (4 2 µg/l) exceed their MCLs but were all qualified as estimated concentrations The reported estimated concentration of iron and manganese in all three water quality samples collected from the Redstone Limestone monitoring wells exceed SMCLs

Dissolved cadmium, iron, magnesium manganese potassium, and sodium were detected above the quantitation limit of the analytical methods in the Redstone Limestone water quality samples

Of the other inorganic parameters nitrate-nitrogen was detected in all three of the Redstone Limestone water quality samples at concentrations ranging from 0 05 mg/l to 0 81 mg/l ammonia nitrogen concentrations ranged from 0 62 mg/l to 2 18 mg/l, COD was detected

in all three samples at concentrations ranging from 5 5 mg/l and 35 5 mg/l chloride concentrations were detected in all three samples ranging from 66 8 mg/l to 101 mg/l sulfate was detected at concentrations ranging from 1 350 mg/l to 2 840 mg/l TDS concentrations ranged from 2 790 mg/l to 4 370 mg/l reported pH values ranged from 6 37 to 7 18 and turbidity ranged from 87 NTUs to 220 NTUs

The reported sulfate and TDS concentrations in all three water quality samples collected from the Redstone Limestone monitoring wells exceed SMCLs

4 3 3 1 Evaluation of the Redstone Limestone Sampling Results

Groundwater sampling results are provided in Table 4-4 Constituents that exceed MCLs detected in the Redstone Limestone water quality samples are presented on Figure 4-3

- One VOC (methylene chloride) was detected above the quantitation limit and was qualified as probable blank contamination
- No PAHs were detected above the quantitation limit of the analytical methods or above MCLs
- B2EHP was detected in the water quality samples at estimated concentrations ranging from 1 µg/l to 4 µg/l which are below the MCL of 6 µg/l
- Groundwater in the Redstone Limestone water-bearing horizon in the vicinity of the southern toe appears to not be affected by VOCs B2EHP, or PAHs
- The concentration of lead (25 4 µg/l) in MW-17C and the estimated concentrations of thallium in MW-17C (4 2 µg/l) MW 16C (3 3 µg/l) and MW-15 (3 7 µg/l) exceed MCLs
- Estimated iron and manganese concentrations in all three Redstone Limestone monitoring wells exceed SMCLs
- The low chloride concentrations in monitoring wells MW-15C MW-16C and MW 17C suggest that these areas may be marginally affected by landfill leachate
- Alkalinity concentrations and pH values in the water quality samples collected from the three monitoring wells suggest that the groundwater in the Redstone Limestone is buffered by the carbonate bedrock
- Sulfate TDS and turbidity concentrations exceeded SMCLs in all three groundwater quality samples

- The absence of organic analytes above quantitation limits suggests that the Redstone Limestone in the vicinity of the southern toe has not been affected by organic materials disposed of in the waste pit

- Sulfate iron manganese and TDS concentrations suggest that the Redstone Limestone monitoring wells may be influenced by acid mine drainage

4 4 Quality Assurance/Quality Control

4 4 1 Chemical Analyses and Quality Assurance Protocols

Chemical analyses of groundwater samples collected during the 1998 interim groundwater monitoring were performed using CLP and other EPA-approved methods and protocols included in SW-846 (3rd Edition) or other EPA manuals or promulgated regulations The groundwater quality samples were collected and analyzed in accordance with the Quality Assurance Project Plan (QAPP) Revision 2 as approved by the U S EPA on November 25 1992 with respect to the RD Work Plan and the Supplemental Hydrogeologic Study

Ten percent of all samples collected during the field activities for laboratory analyses were duplicated During the 1998 interim groundwater monitoring sampling event one duplicate groundwater quality sample (MW-60) was collected from monitoring well MW 11B Water quality sample MW 60 was submitted blind to the laboratory Internal laboratory duplicates were also analyzed at the rate of 1 per every 10 samples submitted for analysis

The accuracy of analytical techniques and instrument calibration was monitored through the use of calibration standards Quality control (QC) checks including the analysis of one field blank and a trip blank provided with each batch of sample containers to the laboratory were used to ascertain the integrity of analyses Methylene chloride acetone and 2-butanone which are common laboratory contaminants were detected in the field blank and the trip blanks Therefore these analytes were qualified as attributable to probable blank contamination in the data tables These qualifications did not affect the overall quality or assessment of the analytical data

Sample matrices were examined to evaluate their effect on the analytical protocol One matrix spike/matrix spike duplicate (MS/MSD) sample was analyzed in conjunction with the 1998 interim groundwater monitoring The MS/MSD sample was analyzed for CLP parameters only (Level IV sample) Matrix spike recoveries laboratory duplicate precision and ICP serial dilutions were outside QC limits for several reported metals This resulted in qualifying the

appropriate metals results as estimated concentrations in the data tables However these qualifications did not affect the overall quality or assessment of the analytical data

Laboratory QC reference samples were integrated into the analytical scheme to assess accuracy All field and laboratory QC samples were analyzed according to the method protocols as regular samples including all spikes dilutions and processing All QC samples were evaluated based on the CLP or other EPA accepted criteria of the relevant analytical level

4 4 2 Data Validation

All samples obtained and analyzed were subjected to data validation using the QA/QC criteria specified in the EPA s guidance documents for data validation or the specific analytical method Data validation was accomplished by Ceimic Corporation s Quality Assurance (QA) Officer and the QA Officer of ESC All laboratory data were validated by ESC s QA Officer using original laboratory reports Ceimic produced data reports that allowed for validation by including all CLP deliverables or QA/QC deliverables for the relevant analytical method Appropriate equations for precision accuracy (bias) and completeness were used for all analyses The data reporting packages were reviewed thoroughly by ESC s QA Officer

The data validation process involved a review of instrument calibration procedures instrument tuning and performance holding times blanks MS/MSD interference in analytical determinations compound identification system performance verifying calculations and data assessment Criteria for accepting and rejecting data was based on EPA s Functional Guidelines for the Evaluation of Organic and Inorganic Analysis (EPA 1988) or the QA/QC criteria for the relevant analytical method

A preliminary review was performed by ESC to verify that all necessary paperwork (chain of custody s traffic reports analytical reports laboratory personnel signatures) and deliverables were present A detailed QA review was performed by ESC to verify the qualitative and quantitative reliability of the data as they were presented This review included a detailed review and interpretation of all data generated by Ceimic

Based on the review of the analytical data an organic and inorganic QA report was prepared and is provided in Appendix C The report consists of a general introduction section followed by qualifying statements that were taken into consideration for the analytical results used in the tables Based on the QA review qualifier codes were placed next to specific sample

results on the sample data tables These qualifier codes serve as an indication of the qualitative and quantitative reliability of the data A glossary of data qualifiers is also included

Based on the QA/QC review detected VOCs SVOCs and metals were qualified as probable blank contamination or estimated concentrations The analytical data as qualified are of acceptable quality and are usable for the purpose of assessing the potential groundwater contamination at the BRL site

5 0 Conclusions

This section summarizes the key results of the 1998 interim groundwater monitoring completed during June 1998 at the BRL site

5 1 Groundwater Flow Directions

One goal of the interim groundwater monitoring was to measure water levels in the unconsolidated material water-bearing horizon the Benwood Limestone Formation and Redstone Limestone Formation for determining and evaluating groundwater flow directions To accomplish this groundwater elevations were measured in five unconsolidated material piezometers one monitoring well installed in the Benwood Limestone and three monitoring wells installed in the Redstone Limestone Based on the groundwater elevation data collected during June 1998 groundwater contour maps for the unconsolidated material and the Redstone Limestone were constructed A groundwater contour map for the Benwood Limestone could not be constructed because only one measurement location was included in the interim groundwater monitoring

Based on the June 1998 water levels groundwater in the unconsolidated material at the southern toe of the BRL site converges toward the seep L-4 discharge Groundwater in the unconsolidated material west of seep L-4 flows southeast towards the former Kings Run valley

Groundwater flow in the Redstone Limestone Formation is toward the south-southeast based on the 1998 data from the three monitoring wells The groundwater flow direction is further supported by the known dip of the bedrock to the southeast

5 2 Groundwater Quality of Unconsolidated Material Horizon

Groundwater quality samples were collected from four piezometers completed in the unconsolidated material at the southern toe of the BRL Based on the analytical data no VOCs except methylene chloride were detected in the water quality samples above MCLs Methylene chloride is a common laboratory contaminant Beryllium and nickel concentrations in P-1B nickel concentrations in P-4 lead and nickel concentrations in P-22 and arsenic lead and nickel concentrations in MW-60 (duplicate of P-22) exceed applicable MCLs Estimated thallium concentrations in P-1B P-4, and P-22 exceed the MCL The reported concentrations of iron

manganese sulfate TDS and turbidity in all four piezometers exceed applicable SMCLs Zinc concentrations in P 1B P-22 and the duplicate sample (MW-60) exceed the MCL Low chloride concentrations suggest that the unconsolidated water-bearing horizon at the southern toe may be marginally affected by landfill leachate Nondetectable alkalinity concentrations low pH values elevated iron sulfate and manganese results indicate that groundwater in the unconsolidated material west of seep L-4 may be affected by acid mine drainage The general absence of organic analytes above quantitation limits suggests that organic materials disposed of in the waste pit area are not migrating offsite through the unconsolidated material at the southern toe of the BRL

5 3 Groundwater Quality of the Benwood Limestone

One groundwater quality sample was collected from MW 11B this well was installed along the eastern margin of the BRL site during the RI/FS investigation

Based on the analytical data one VOC (methylene chloride) was detected above its MCL but was attributed to blank contamination Thallium concentrations in the water sample exceeded the applicable MCL of 0 002 mg/l however the reported concentration was qualified as an estimated concentration after completion of the QA/QC review Concentrations of iron manganese sulfate TDS and turbidity exceed applicable SMCLs The low chloride concentration suggests that this area is only marginally affected by landfill leachate Low iron sulfate and manganese concentrations suggest that this area is only marginally affected by acid mine drainage The general absence of organic analytes above quantitation limits suggests that organic materials disposed of in the waste pit area are not migrating beyond the facility boundaries through the Benwood Limestone aquifer in this general area of the BRL

5 4 Groundwater Quality of the Redstone Limestone

Three water quality samples were collected from the Redstone Limestone monitoring wells installed across the southern toe and analyzed for the constituents listed in the approved interim groundwater monitoring plan

Methylene chloride was detected above its quantitation limit and was attributed to blank contamination B2EHP was detected in two of the water quality samples at estimated concentrations below its MCL B2EHP is a common laboratory contaminant Concentrations of

lead in MW-17C and thallium in MW-15C MW-16C and MW-17C exceed applicable MCLs all reported thallium concentrations were qualified as estimated concentrations after completion of the QA/QC review Reported concentrations of iron manganese sulfate TDS and turbidity exceed SMCLs Low chloride concentrations in the groundwater monitoring wells indicate that the Redstone Limestone horizon at the southern toe of the BRL may be marginally affected by landfill leachate Concentrations of iron sulfate manganese and TDS suggest that the Redstone Limestone Formation may be affected by acid mine drainage The general absence of organic analytes suggests that organic materials disposed of in the waste pit area are not migrating beyond the facility boundaries and that the Redstone Limestone horizon has not been adversely affected by the landfill activities

6 0 References

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Table 2 1

Construction Data for Piezometers and Monitoring Wells
Interim Groundwater Monitoring
Buckeye Reclamation Landfill
Belmont County, Ohio

Monitoring Well/ Piezometer	Surface Elevation (ft/MSL)	Top of Casing Elevation (ft/MSL)	Total Depth (ft)(a)	Monitoring Interval (ft)(b)	Well Diameter (in)
Unconsolidated					
P 1B	850 6	853 02	29 31	24 5 26 5	2
P 2	852 0	853 11	15 13	11 0 13 0	2
P 4	873 7	875 61	25 30	13 0 23 0	2
P 13	961 0	963 21	19 42	13 0 18 0	2
P 22	861 2	863 54	32 00	19 0 21 5	2
Benwood Limestone					
MW 11B	936 6	937 90	34 40	17 0 32 0	2
Redstone Limestone					
MW 15C	852 0	854 61	54 30	29 0 52 0	2
MW 16C	851 4	853 66	49 40	34 8 46 5	2
MW 17C	860 5	863 30	67 66	47 0 65 5	2

a/ Measured from top of PVC casing
b/ Measured from ground surface

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Table 3 1

Water Table Elevations for Piezometers and Monitoring Wells
Buckeye Reclamation Landfill
Belmont County, Ohio
June 22, 1998 (a)

Well/ Piezometer	Top of PVC Casing Elevation	Depth to Water (ft) (b)	Water Table Elevation
Unconsolidated Material			
P 1B	853 02	9 89	843 13
P 2	853 11	3 19	849 92
P 4	875 61	11 21	864 40
P 13	963 21	11 51	951 70
P 22	863 54	16 46	847 08
Benwood Limestone			
MW 11B	937 90	20 48	917 42
Redstone Limestone			
MW 15C	854 61	41 72	812 89
MW 16C	853 66	41 18	812 48
MW 17C	863 30	62 13	801 17

a/ All elevations in feet above mean sea level
b/ Top of PVC casing

Table 4 1

Final Field Measurements
Piezometers and Monitoring Wells
Buckeye Reclamation Landfill
Belmont County, Ohio
June 23 24, 1998

Well/Piezometer	Temperature (C)	Specific Conductivity (ms/cm)	pH	Turbidity (NTU)	Total Alkalinity (mg/l)
Unconsolidated					
P 1B	15 1	383	3 40	111	<20
P 2	14 1	266	6 18	240	840
P 4	13 8	345	6 20	>999	1000
P 22	15 0	352	4 54	>999	60
Benwood Limestone					
MW 11B	15 2	193	6 49	173	440
Redstone Limestone					
MW 15C	15 7	390	6 32	960	800
MW 16C	15 6	390	6 28	221	840
MW 17C	16 6	317	6 84	>999	840

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Table 4-2

Groundwater Sampling Results Unconsolidated Material
Buckeye Reclamation Landfill
Belmont County Ohio(a)
June 23-24 1998

Compound	P 1B	P 2	P-4	P 22	MW-60 (b)	MCLs (c)	SMCLs (d)
VOCs (µg/l)							
Methylene Chloride	19	7	9	5 B	7 B	5	
Acetone	10 U	10 U	41	10 U			
Total Metals (ug/l)							
Arsenic	8 2 J	2 3 U	25 5	43	52 2	50	
Barium	64 8 J	24 6 J	167 J	87 1 J	104 J	2 000	
Beryllium	10 3	0 19 U	0 19 U	3 9 J	2 9 J	4	
Calcium	437 000	378 000	428 000	442 000	372 000		
Chromium	54 5	6 1 U	20 3	71 6	66	100	
Cobalt	111	5 U	105	58 5	60 1		
Copper	14 9 J	5 UJ	17 2 J	101 J	104 J		1 000
Iron	461 000 J	1 600 J	38 700 J	583 000 J	477 000 J		300
Lead	5 5	1 7 U	14 7	65 5	87	15	
Magnesium	68 500 J	104 000 J	133 000 J	78 900 J	70 100		
Manganese	2 950 J	750 J	5 470 J	3 950	3 370 J		50
Nickel	433	9 2 J	186	174	167	100	
Potassium	17 400	971 J	6 650	14 200	14 500		
Sodium	143 000 J	101 000 J	187 000 J	98 800 J	88,500 J		
Thallium	6 6 J	1 7 U	7 3 J	4 8 J	8 1 J	2	
Vanadium	78	6 2 J	20 J	56 3	68 8		
Zinc	2 020 J	57 2 J	191 J	803 J	744 J		500
Dissolved Metals (ug/l)							
Arsenic	2 3 U	2 3 U	9 9 J	37 3	34 1		
Barium	132 J	196 J	194 J	127 J	77 J		
Beryllium	8 5	0 91 U	0 91 U	1 9 J	1 4 J		
Calcium	404 000	423 000	481 000	404 000	366 000		
Chromium	46 3	6 1 U	6 1 U	40 7	32 5		
Cobalt	102	5 U	7 7 J	29 3 J	29 3 J		
Copper	12 9 J	5 UJ	5 UJ	5 UJ	5 UJ		
Iron	478 000	45 J	24 000	323 000	498 000		
Lead	6	1 7 U	1 7 U	13 8	6 8		
Magnesium	60 700	120 000	164 000	79 300	70 600		
Manganese	2 680	524	6,230	3 590	3 240		
Nickel	399	12 3 J	36 3 J	97 1	88 4		
Potassium	15 500	1 050 J	3 180 J	12 200	10 600		
Sodium	128 000	125 000	251 000	108 000	95 600		
Thallium	1 7 U	1 8 J	1 7 U	1 7 U	2 2 J		
Vanadium	66	5 9 J	5 3 U	11 4 J	19 9 J		
Zinc	2 700 J	157 J	195 J	1 160 J	816 J		
Other Analytical Parameters (mg/l)							
Alkalinity	2 U	688	774	2 U	20		
Ammonia nitrogen	3 32	0 23	0 94	4 35	4 46		
Chemical oxygen demand	93 1	5 U	231	137	352		
Chloride	52	90 1	203	25	24 5		250
pH (units)	3 56	6 43	6 28	4 71	4 74		6 5 8 5
Specific Conductance (umhos/cm)	3,550	2 940	3 860	3 700	3 690		
Sulfate	3 960	1 300	1 430	3 360	3 460		250
Total dissolved solids	5 400	2 760	3 370	4 670	4 660		500
Turbidity (NTU)	34	92	1 750	1 950	2 600		1

a/ U=undetected J=estimated concentration B=probable blank contamination
MCL = Maximum Contaminant Level SMCL = Secondary Maximum Contaminant Level
b/ Duplicate of P 22
c/ MCLs based on EPA January 1998 standards
d/ SMCLs based on EPA January 1998 standards

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Table 4-3

Groundwater Sampling Results, Benwood Limestone
Buckeye Reclamation Landfill
Belmont County Ohio(a)
June 23 1998

Compound	MW 11B	MCLs	SMCLs
VOCs (µg/l)			
Methylene Chloride	6 B	5	
Total Metals (ug/l)			
Arsenic	2 3 U	50	
Barium	12 8 J	2 000	
Beryllium	0 91 U	4	
Calcium	366 000		
Chromium	6 1 U	100	
Cobalt	13 9 J		
Copper	5 UJ		1 000
Iron	3 100 J		300
Lead	1 7 U	15	
Magnesium	75 800		
Manganese	773 J		50
Nickel	13 3 J	100	
Potassium	3 470 J		
Sodium	75 000 J		
Thallium	2 9 J	2	
Vanadium	5 3 U		
Zinc	54 6 J		500
Dissolved Metals (ug/l)			
Arsenic	2 3 U		
Barium	172 J		
Beryllium	0 91 U		
Calcium	311 000		
Chromium	6 1 U		
Cobalt	6 2 J		
Copper	5 UJ		
Iron	1 690		
Lead	1 7 U		
Magnesium	70 800		
Manganese	668		
Nickel	8 8 U		
Potassium	3 410 J		
Sodium	76 300		
Thallium	1 9 J		
Vanadium	5 3 U		
Zinc	744		
Other Analytical Parameters (mg/l)			
Alkalinity	400		
Ammonia nitrogen	0 49		
Chemical oxygen demand	10 6		
Chloride	66 4		250
pH (units)	6 62		6 5 8 5
Specific Conductance (umhos/cm)	2 060		
Sulfate	972		250
Total dissolved solids	1 850		500
Turbidity (NTU)	14 2		1

a/ U=undetected J=estimated concentration B=probable blank contamination
MCL = Maximum Contaminant Level SMCL = Secondary Maximum Contaminant Level
b/ MCLs based on EPA January 1998 standards
c/ SMCLs based on EPA January 1998 standards

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Table 4-4

Groundwater Sampling Results, Redstone Limestone
Buckeye Reclamation Landfill
Belmont County Ohio(a)
June 23-24 1998

Compound	MW 15C	MW 16C	MW 17C	MCLs (b)	SMCLs (c)
VOCs (µg/l)					
Methylene Chlonde	5 U	6 B	7 B	5	
SVOCs (µg/l)					
Bis(2-ethylhexyl)phthalate	10 U	4 J	1 J	6	
Total Metals (µg/l)					
Arsenic	2 3 U	2 3 U	15 5	50	
Barium	11 4 J	35 7 J	488 J	2 000	
Beryllium	0 91 U	0 91 U	1 2 J	4	
Calcium	400 000	524 000	89 200		
Chromium	6 1 U	6 1 U	21 8	100	
Cobalt	7 7 J	8 5 J	12 3 J		
Copper	5 UJ	5 UJ	15 6 J		1 000
Iron	10 800 J	8 440 J	13 900 J		300
Lead	1 7 U	1 7 U	25 4	15	
Magnesium	320 000 J	281 000 J	33 100 J		
Manganese	386 J	306 J	147 J		50
Nickel	9 2 J	19 9 J	27 1 J	100	
Potassium	6 370	7 140	7 950		
Selenium	3 6 U	3 6 U	6	50	
Sodium	240 000 J	227 000 J	734 000 J		
Thallium	3 7 J	3 3 J	4 2 J	2	
Vanadium	7 8 J	5 3 U	33 5 J		
Zinc	111 J	70 9 J	132 J		500
Dissolved Metals (µg/l)					
Barium	5 25 J	121 J	255 J		
Cadmium	0 27 U	0 27 U	0 46 J		
Calcium	446 000	470 000	82,500		
Cobalt	5 U	10 8 J	5 U		
Copper	5 UJ	5 UJ	5 UJ		
Iron	10,500	4 360	137		
Magnesium	270 000	260 000	30,500		
Manganese	386	258	68 2		
Nickel	8 8 U	23 J	8 8 U		
Potassium	7 900	6 640	4 800 J		
Silver	3 9 J	2 8 U	3 9 J		
Sodium	313 000	219 000	711 000		
Thallium	2 5 J	2 4 J	2 2 J		
Zinc	93 4 J	185 J	351 J		
Other Analytical Parameters (mg/l)					
Alkalinity	641	758	820		
Ammonia nitrogen	2 18	1 54	0 62		
Chemical oxygen demand	5 5	35 5	10 6		
Chlonde	99 3	101	66 8		250
Nitrate nitrogen	0 07	0 05	0 81		
pH (units)	6 37	6 45	7 18		6 5 8 5
Specific Conductance (umhos/cm)	4 340	4 120	3 610		
Sulfate	2 840	2 740	1 350		250
Total dissolved solids	4,280	4 370	2 790		500
Turbidity (NTU)	87	88 5	220		1

a/ U=undetected J=estimated concentration B=probable blank contamination
MCLs = Maximum Contaminant Level SMCLs = Secondary Maximum Contaminant Level
b/ MCLs based on EPA January 1998 standards
c/ SMCLs based on EPA January 1998 standards

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Figures

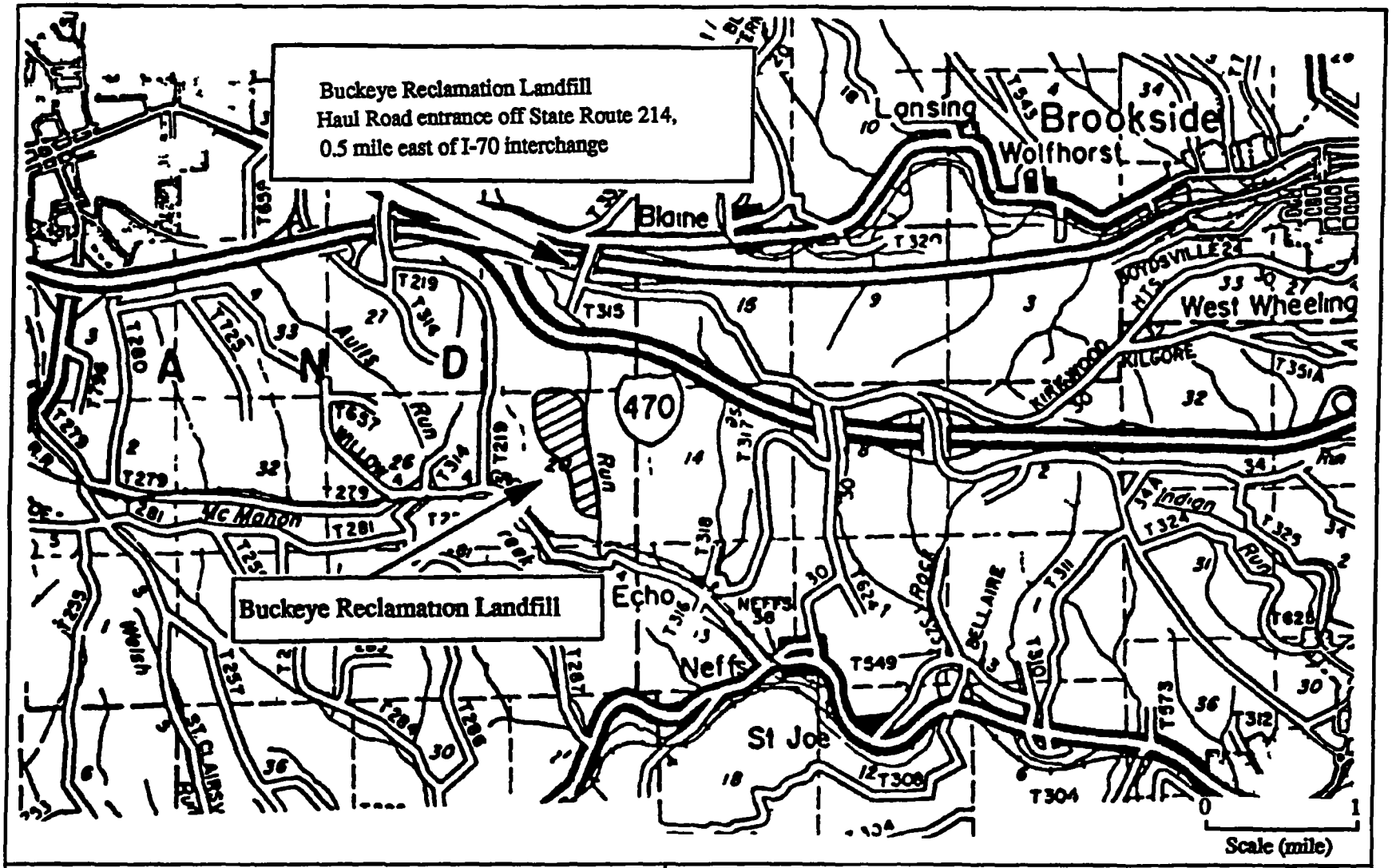

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Figure 1-1

Site Location
Buckeye Reclamation Landfill Site
Belmont County Ohio

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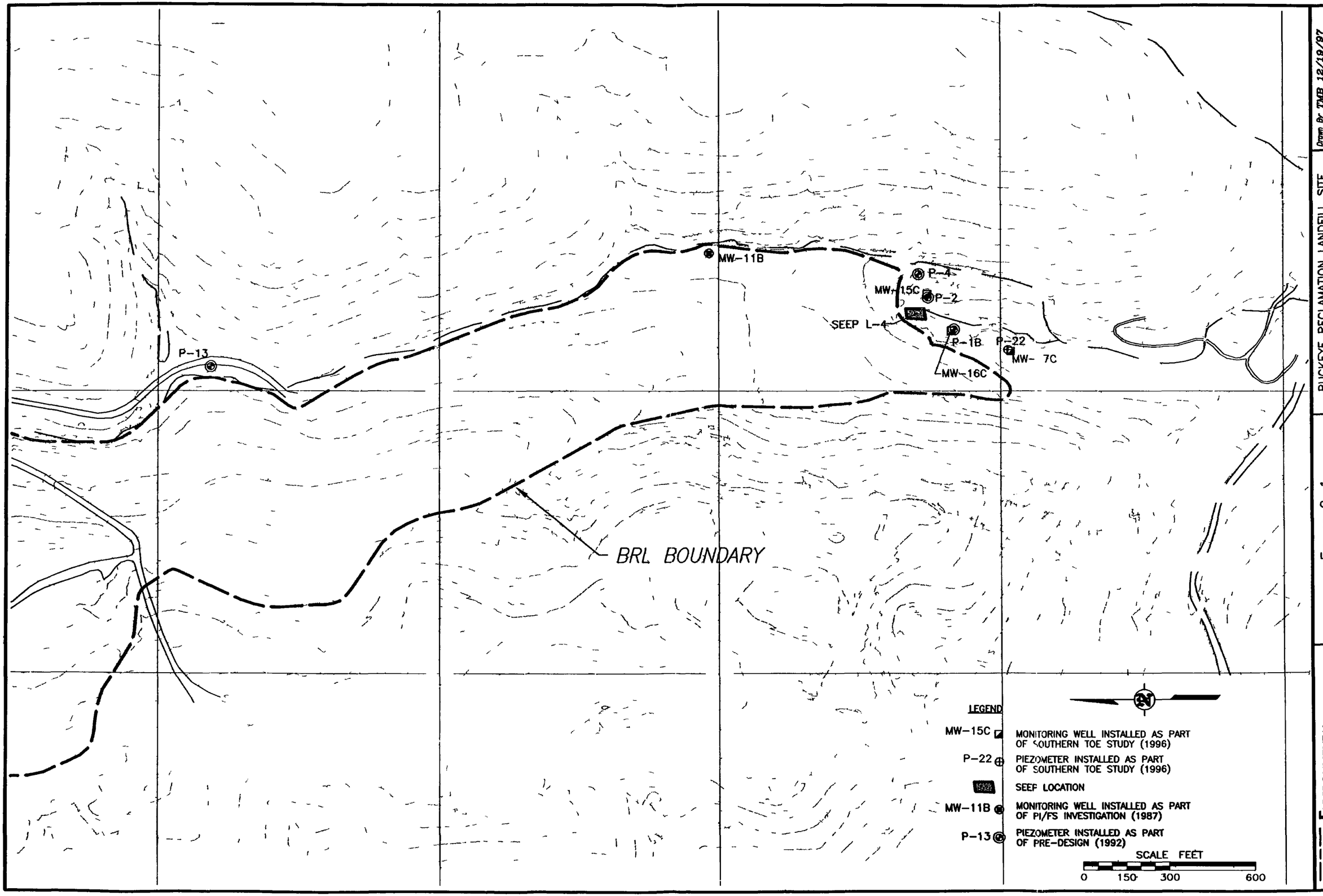

BUCKEYE RECLAMATION LANDFILL SITE
BELMONT COUNTY OHIO

PREPARED FOR
BUCKEYE RECLAMATION LANDFILL STEERING COMMITTEE
PITTSBURGH PENNSYLVANIA

Figure 2-1

LOCATION OF INTERIM GROUNDWATER MONITORING PIEZOMETERS AND MONITORING WELLS

Drawn By TMB 12/19/97
Checked
Approved
Drawing Number 144195-B1

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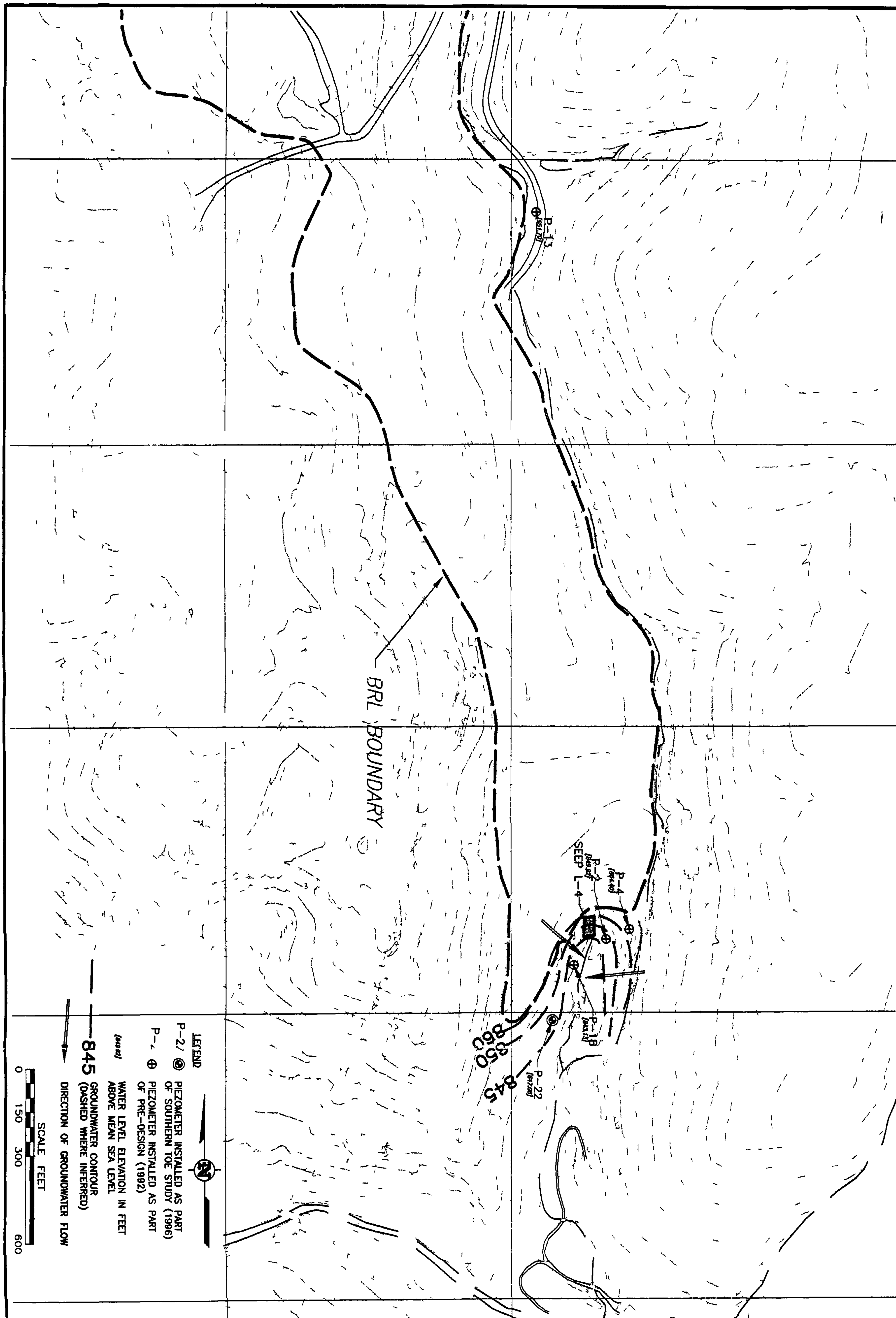

ENVIRONMENTAL STRATEGIES CORPORATION Four Penn Center West, Suite 315 Pittsburgh Pennsylvania 15276 (412) 787-5100	Figure 3-1 GROUNDWATER CONTOUR MAP UNCONSOLIDATED MATERIAL JUNE 1998	BUCKEYE RECLAMATION LANDFILL SITE BELMONT COUNTY OHIO PREPARED FOR BUCKEYE RECLAMATION LANDFILL STEERING COMMITTEE PITTSBURGH PENNSYLVANIA	Drawn By TMB 12/19/97 Checked: Approved: Drawing Number 144195-B22

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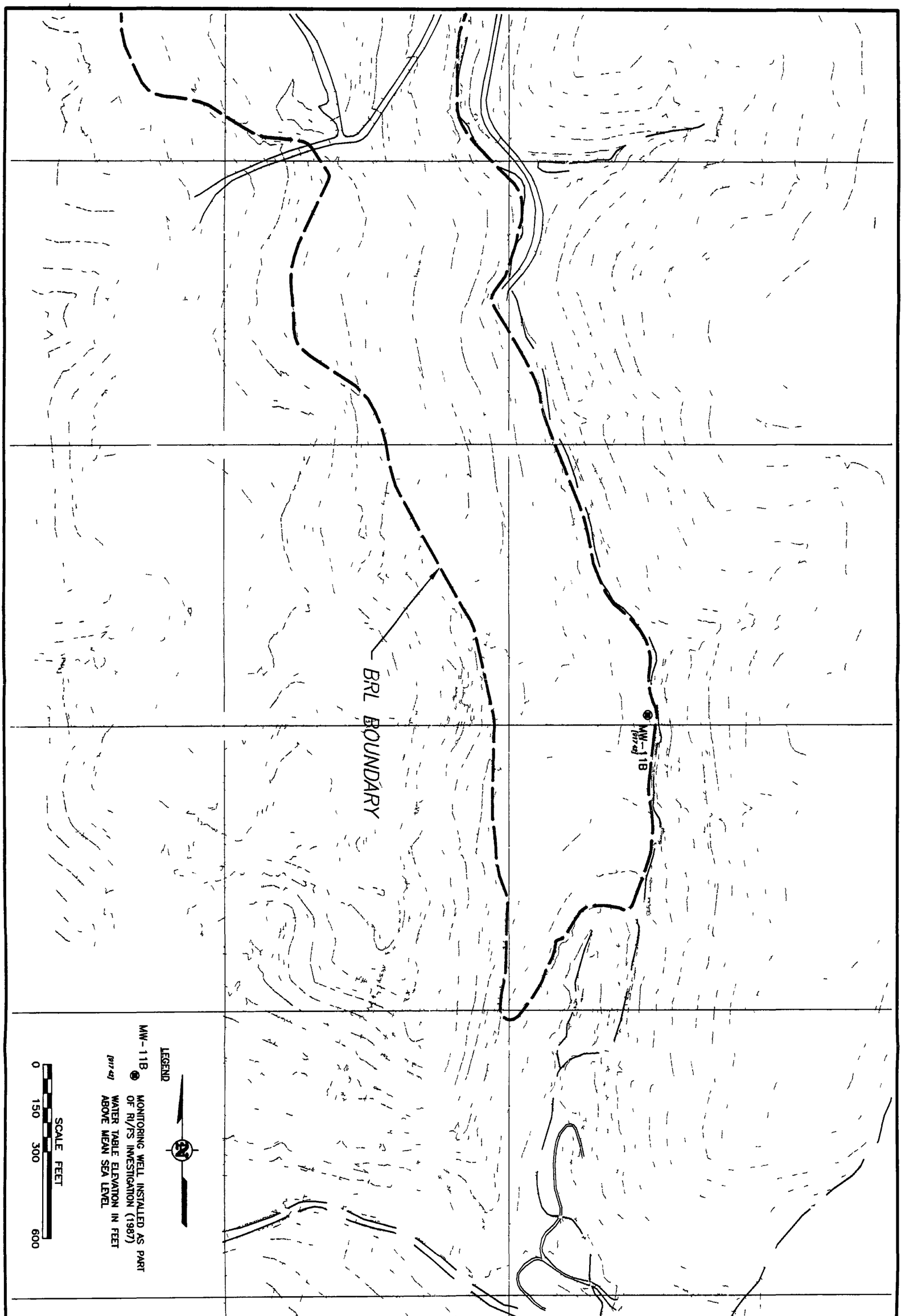

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Figure 3-2

WATER TABLE ELEVATION
BENWOOD LIMESTONE JUNE 1998

BUCKEYE RECLAMATION LANDFILL SITE
BELMONT COUNTY OHIO
PREPARED FOR
BUCKEYE RECLAMATION LANDFILL STEERING COMMITTEE
PITTSBURGH PENNSYLVANIA

Drawn By TMB 12/19/97
Checked.
Approved.
Drawing Number 144195-B23

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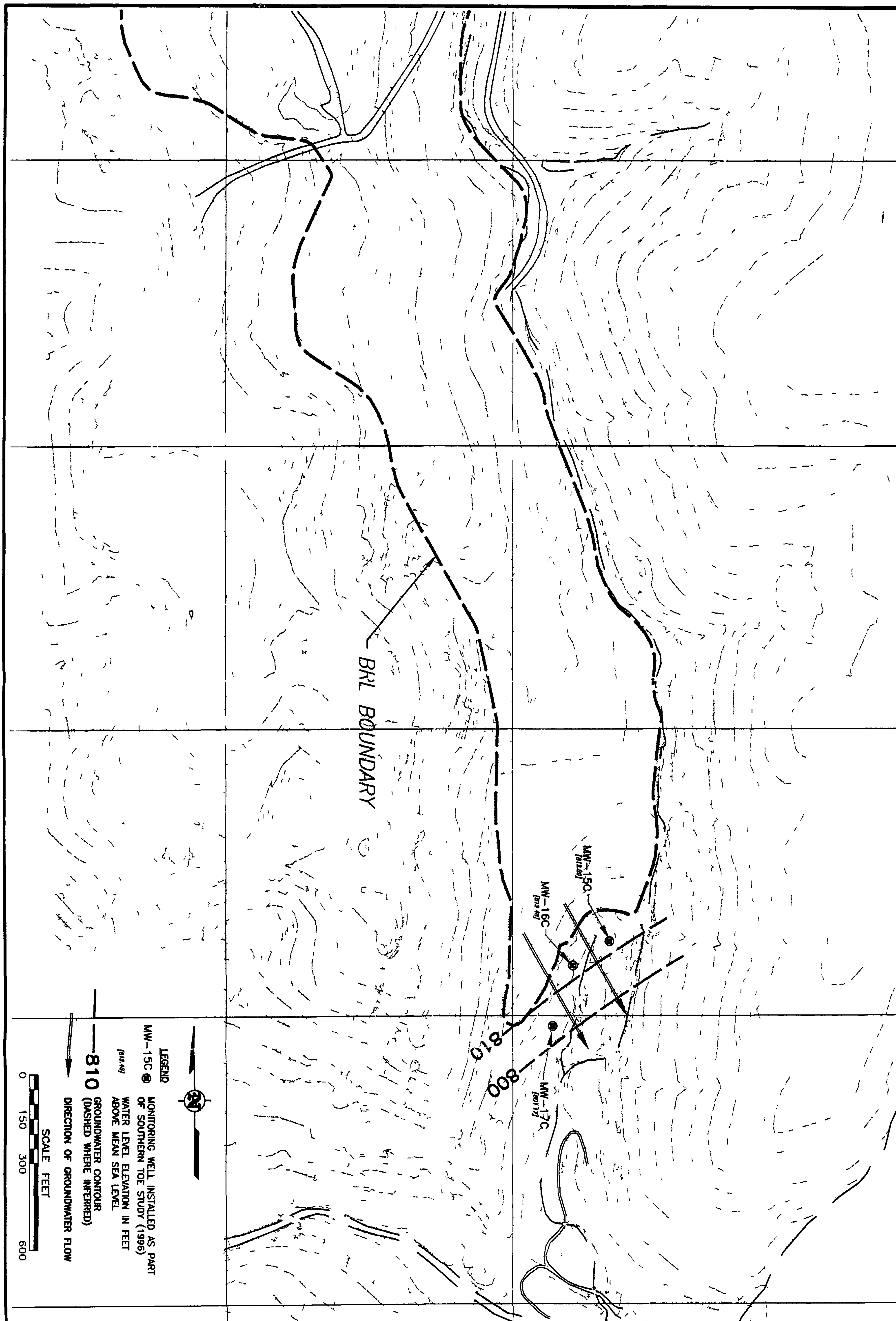

ESC **ENVIRONMENTAL STRATEGIES CORPORATION** Four Penn Center West, Suite 315 Pittsburgh Pennsylvania 15276 (412) 787-5100	Figure 3-3 GROUNDWATER CONTOUR MAP REDSTONE LIMESTONE JUNE 1998	BUCKEYE RECLAMATION LANDFILL SITE BELMONT COUNTY OHIO PREPARED FOR BUCKEYE RECLAMATION LANDFILL STEERING COMMITTEE PITTSBURGH PENNSYLVANIA	Drawn By RAZ 112397 Checked Approved Drawing Number 464313-B24

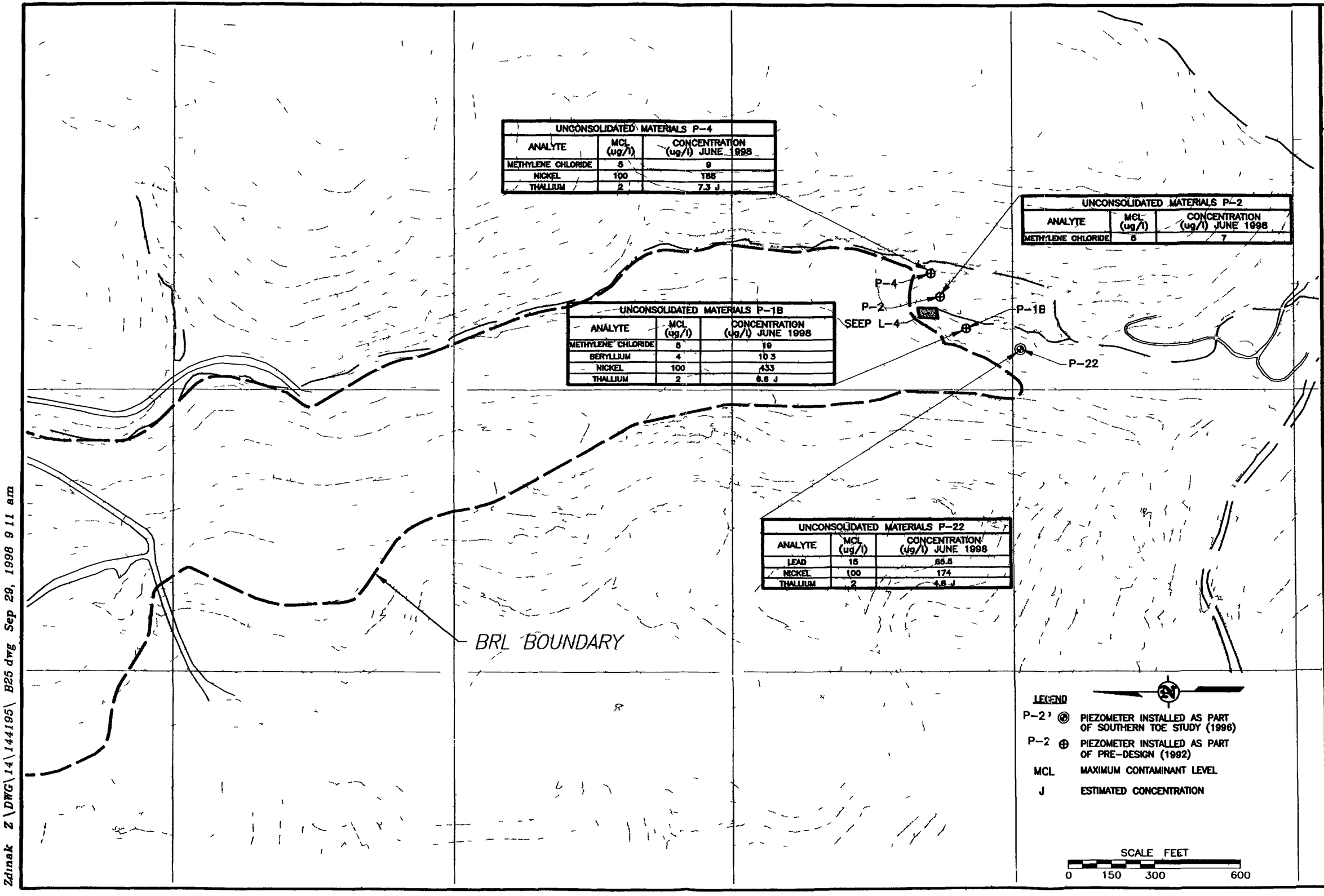

Figure 4-1
GROUNDWATER SAMPLING LOCATIONS WHERE ANALYTE CONCENTRATIONS EXCEED THE MAXIMUM CONTAMINANT LEVEL (MCL) UNCONSOLIDATED MATERIALS JUNE 1998

BUCKEYE RECLAMATION LANDFILL SITE
BELMONT COUNTY, OHIO
PREPARED FOR
BUCKEYE RECLAMATION LANDFILL STEERING COMMITTEE
PITTSBURGH PENNSYLVANIA

Drawn By TMB 12/19/97
Checked
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Drawing Number 144195-B25

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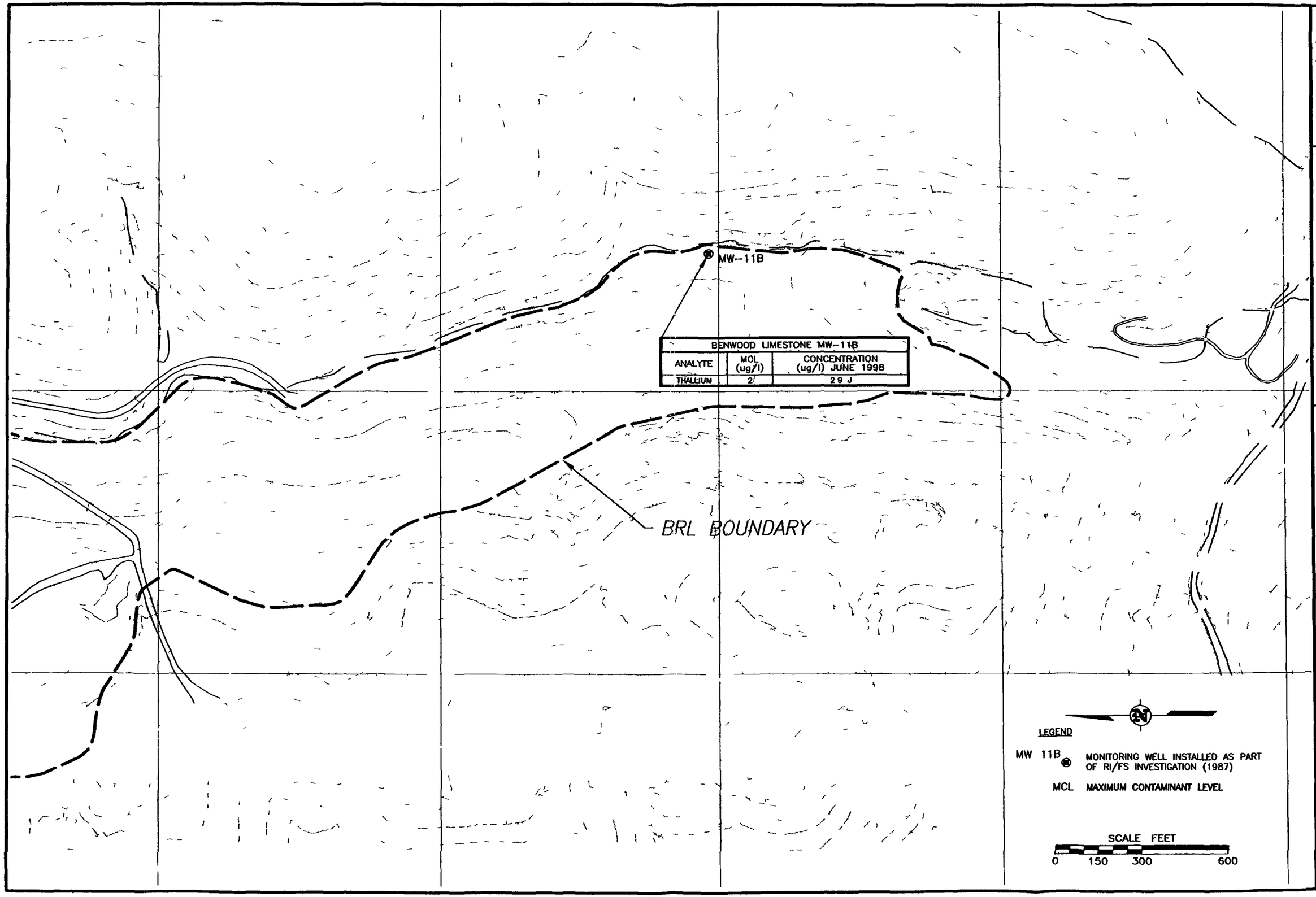

Figure 4-2
GROUNDWATER SAMPLING LOCATION WHERE ANALYTE CONCENTRATION EXCEEDS THE MAXIMUM CONTAMINANT LEVEL (MCL) BENWOOD LIMESTONE, JUNE 1998

BUCKEYE RECLAMATION LANDFILL SITE
BELMONT COUNTY OHIO
PREPARED FOR
BUCKEYE RECLAMATION LANDFILL STEERING COMMITTEE
PITTSBURGH PENNSYLVANIA

Drawn By: TMB 12/19/97
Checked:
Approved:
Drawing Number: 144195-B26

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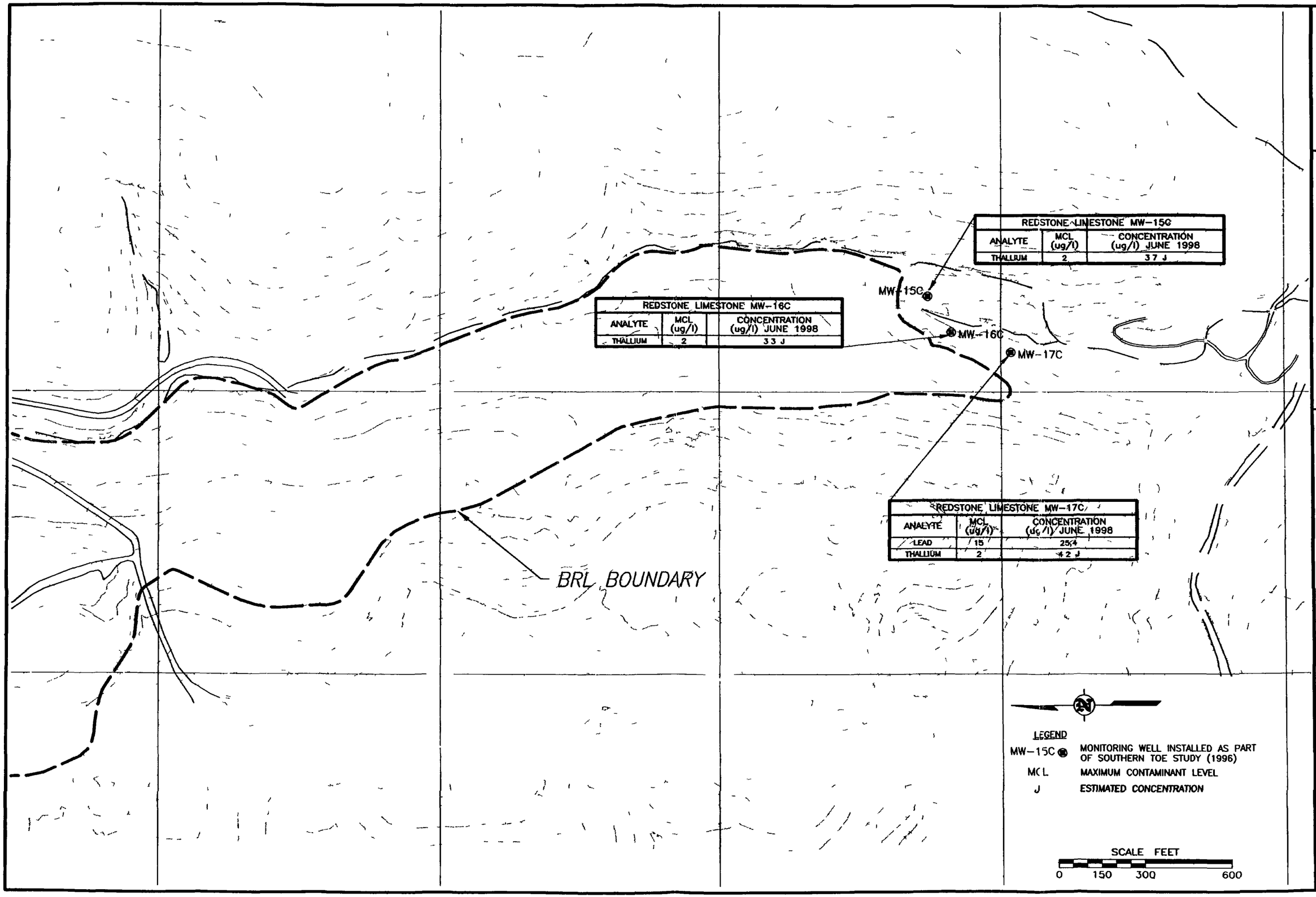

Figure 4-3
GROUNDWATER SAMPLING LOCATIONS WHERE ANALYTE CONCENTRATION EXCEEDS MAXIMUM CONTAMINANT LEVEL (MCL) REDSTONE LIMESTONE JUNE 1998

BUCKEYE RECLAMATION LANDFILL SITE
BELMONT COUNTY OHIO
PREPARED FOR
BUCKEYE RECLAMATION LANDFILL STEERING COMMITTEE
PITTSBURGH PENNSYLVANIA

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Appendix A - Groundwater Monitoring Data Log Forms

GROUNDWATER MONITORING DATA LOG

Well No /Designation P-1B Date 6-23-98

Site Data

Site Name· Buckeye ESC Personnel. BCB/JSC

Site Address St Clairsville, OH ESC Project No . 144195-1

Weather Conditions. Sunny, Hot, & Humid

Well Description

Well Location. P-1B Toe of Landfill

Well Security Locking Protection

Casing Material· Inner PVC Outer Steel

Well Stick up or Depth Below Ground Surface _____

Organic Vapors (HNu, OVA, TIP) Wellhead 0 ppm

Breathing Zone 0 ppm

Nonaqueous Phase (Thickness and composition) -

Reference Point (i e , top of PVC casing) TPVC

Purge Data

Purge Method Bailing

Note: Allow water level to equilibrate after removing well cap

Total Well Depth (TD): 24.10 ft Depth to Water (DTW)· 9.89 ft

Casing Inner Diameter (CID) _____ inches

To calculate well volume Well Vol.(gal.) = $(CID)^2(0\ 041)(TD-DTW)$

Well Volume. 2.4 gal. x 3 = Purge Volume 7.2 gal

Purge Time Begin 1045 End 1115

Prepurge Data. Temp 16.9°C pH 3 89 Spec Cond 382 ms/cm Turb 124

Volume 1 Temp 15.8 pH 3.50 Spec. Cond 378 280

Volume 2· Temp 15.1 pH 3.40 Spec. Cond 383 111

Volume 3 Temp _____ pH _____ Spec. Cond. Bailed dry @ 2 Volume

Alkalinity drops H_2SO_4 x 20 = mg/L

Solution turned pink w/o adding H_2SO_4, ∴, Alkalinity is < 20 mg/L

GROUNDWATER MONITORING DATA LOG

Well No /Designation P-4 Date 6-24-98

Site Data

Site Name Buckeye ESC Personnel. BCB/JSC

Site Address St. Clairsville ESC Project No. 144195-1

Weather Conditions. Warm, Overcast, Humid

Well Description

Well Location P-2 Toe of Landfill

Well Security Locking Caver

Casing Material Inner PVC Outer Steel

Well Stick up or Depth Below Ground Surface.

Organic Vapors (HNu, OVA, TIP) Wellhead Ø 9 ppm

Breathing Zone 0 ppm

Nonaqueous Phase (Thickness and composition) -

Reference Point (i e , top of PVC casing) TPVC

Purge Data

Purge Method Bailing

Note: Allow water level to equilibrate after removing well cap.

Total Well Depth (TD): 25.54 ft Depth to Water (DTW) 11.21 ft

Casing Inner Diameter (CID) 2 inches

To calculate well volume Well Vol.(gal) = $(CID)^2(0.041)(TD-DTW)$

Well Volume 2.4 gal x 3 = Purge Volume 7.2 gal

Purge Time. Begin 745 End 815

Prepurge Data Temp 13.9 pH 6.21 Spec. Cond 337 ms/cm Turb 106

Volume 1 Temp 15.2 pH 6.28 Spec Cond 351 115

Volume 2 Temp 13.8 pH 6.08 Spec. Cond 347 >999

Volume 3 Temp 13.8 pH 6.20 Spec Cond 345 >999

Alkalinity 50 drops H_2SO_4 x 20 = 1000 mg/L

GROUNDWATER MONITORING DATA LOG

Well No /Designation P-2 Date 6-24-98

Site Data

Site Name Buckeye ESC Personnel. BCB/JSC

Site Address St Charsville ESC Project No . 14495-1

Weather Conditions Warm, Overcast, & Humid

Well Description

Well Location P-2 Toe of Landfill

Well Security. Locking Steel Security Casing

Casing Material· Inner PVC Outer Steel

Well Stick up or Depth Below Ground Surface -

Organic Vapors (HNu, OVA, TIP) Wellhead 0 ppm

Breathing Zone 0 ppm

Nonaqueous Phase (Thickness and composition) -

Reference Point (i e , top of PVC casing) TPVC

Purge Data

Purge Method Bailing

Note: Allow water level to equilibrate after removing well cap

Total Well Depth (TD): 15.45 ft Depth to Water (DTW) 3.19 ft

Casing Inner Diameter (CID) 2 inches

To calculate well volume Well Vol.(gal) = $(CID)^2(0\ 041)(TD-DTW)$

Well Volume. 2 gal. x 3 = Purge Volume 6 gal

Purge Time Begin 1015 End 1025 Turb

Prepurge Data Temp 15.3 pH 6 42 Spec. Cond 260 188

Volume 1 Temp 15 4 pH 6 39 Spec Cond. 258 185

Volume 2 Temp 14 8 pH 6 25 Spec Cond 261 356

Volume 3 Temp 14 1° pH 6 18 Spec Cond. 266 240

Alkalinity ½ drops H_2SO_4 x 20 = 840 mg/L

GROUNDWATER MONITORING DATA LOG

Well No /Designation P-22 Date 6-23-98

Site Data

Site Name Buckeye ESC Personnel BCB/JSC

Site Address St Marysville OH ESC Project No : 14195-1

Weather Conditions. Sunny, Hot, & Humid

Well Description

Well Location. P-22 Toe of Landfill

Well Security Locking Protection

Casing Material· Inner PVC Outer Metal

Well Stick up or Depth Below Ground Surface _____

Organic Vapors (HNu, OVA, TIP) Wellhead 0 ppm

Breathing Zone 0 ppm

Nonaqueous Phase (Thickness and composition). _____

Reference Point (i e , top of PVC casing) TPVC

Purge Data

Purge Method Bailing

Note: Allow water level to equilibrate after removing well cap

Total Well Depth (TD): 30.90 ft Depth to Water (DTW) 16.46 ft

Casing Inner Diameter (CID) 2 inches

To calculate well volume Well Vol.(gal) = $(CID)^2(0.041)(TD-DTW)$

Well Volume 2.3 gal x 3 = Purge Volume 6.9 gal

Purge Time Begin 755 End 915

Prepurge Data. Temp 15.2 pH 4.42 Spec. Cond 346 Turb

2.3 Volume 1: Temp 14.6°C pH 4.44 Spec Cond 349 mS/cm >999

4.6 Volume 2 Temp 14.9 pH 4.49 Spec. Cond 349 >999

6.9 Volume 3 Temp 15.0 pH 4.54 Spec Cond 352 >999

Alkalinity 3 drops H_2SO_4 x 20 = 60 mg/L

GROUNDWATER MONITORING DATA LOG

Well No /Designation MW-15C Date 6-24-98

Site Data

Site Name Buckeye ESC Personnel. BCB/JSC

Site Address. St Clairsville ESC Project No : 144195-1

Weather Conditions. Warm, Overcast, & Humid

Well Description

Well Location MW-15 Toe of Landfill

Well Security Locking Security Casing

Casing Material· Inner PVC Outer Steel

Well Stick up or Depth Below Ground Surface -

Organic Vapors (HNu, OVA, TIP) Wellhead 0 ppm

Breathing Zone 0 ppm

Nonaqueous Phase (Thickness and composition) -

Reference Point (i e , top of PVC casing) TPVC

Purge Data

Purge Method Bailing

Note: Allow water level to equilibrate after removing well cap.

Total Well Depth (TD): 54.25 ft Depth to Water (DTW) 41.77 ft

Casing Inner Diameter (CID) 2 inches

To calculate well volume Well Vol.(gal) = $(CID)^2(0.041)(TD-DTW)$

Well Volume 2 gal x 3 = Purge Volume 6 gal

Purge Time Begin 900 End 915

Prepurge Data.	Temp 17.9	pH 6.41	Spec Cond 393 ms/cm		Turb 152
Volume 1	Temp 17.2	pH 6.18	Spec Cond 391		131
Volume 2	Temp 17.4	pH 6.28	Spec Cond 389		971
Volume 3	Temp 15.7	pH 6.32	Spec Cond 390		960

Alkalinity 40 drops H_2SO_4 x 20 = 800 mg/L

GROUNDWATER MONITORING DATA LOG

Well No /Designation MW-11B Date 6-23-98

Site Data

Site Name Buckeye ESC Personnel. BCB/JSC

Site Address St. Clarsville ESC Project No : 144195-1

Weather Conditions Hot, Sunny & Humid

Well Description

Well Location. MW-11B

Well Security Locking Protection

Casing Material Inner PVC Outer Steel

Well Stick up or Depth Below Ground Surface

Organic Vapors (HNu, OVA, TIP) Wellhead 0 ppm

Breathing Zone 0 ppm

Nonaqueous Phase (Thickness and composition) -

Reference Point (i e , top of PVC casing) TPVC

Purge Data

Purge Method Bailing

Note: Allow water level to equilibrate after removing well cap

Total Well Depth (TD) 39.49 ft Depth to Water (DTW) 20.48 ft

Casing Inner Diameter (CID) · 2 inches

To calculate well volume Well Vol.(gal) = (CID)^2(0 041)(TD-DTW)

Well Volume. 3.2 gal x 3 = Purge Volume 9.6 gal

Purge Time Begin 1430 End 1500

Prepurge Data. Temp 15.2 pH 6 80 Spec. Cond 206 Turb 136

Volume 1 Temp 15.7 pH 6 5 3 Spec. Cond. 211 135

Volume 2 Temp 15 4 pH 6.47 Spec. Cond 199 106

Volume 3 Temp 15.2 pH 6.49 Spec Cond 193 173

Alkalinity 22drops H_2SO_4 x 20 = mg/L 440

GROUNDWATER MONITORING DATA LOG

Well No /Designation MW-16C Date 6-23-98

Site Data

Site Name Buckeye ESC Personnel. BCB/JSC

Site Address. St. Clarsville ESC Project No . 144195-1

Weather Conditions Hot, Sunny, & Humid

Well Description

Well Location MW-16C, Toe of Landfill Slope

Well Security Locking Protection

Casing Material· Inner PVC Outer Steel

Well Stick up or Depth Below Ground Surface _____

Organic Vapors (HNu, OVA, TIP) Wellhead 0 ppm

Breathing Zone 0 ppm

Nonaqueous Phase (Thickness and composition) -

Reference Point (i e , top of PVC casing) TPVC

Purge Data

Purge Method Bailing

Note: Allow water level to equilibrate after removing well cap.

Total Well Depth (TD): 49.70 ft Depth to Water (DTW) 41.18 ft

Casing Inner Diameter (CID)· 2 inches

To calculate well volume Well Vol.(gal) = (CID)^2(0 041)(TD-DTW)

Well Volume 1.5 gal x 3 = Purge Volume 4.5 gal

Purge Time Begin 1130 End 1155 Turb

Prepurge Data· Temp 16 0 pH 5.61 Spec. Cond 4030 , >999

Volume 1 Temp 16 2 pH 6 32 Spec. Cond. 381 156

Volume 2 Temp 16 0 pH 6.31 Spec. Cond 389 113

Volume 3 Temp 15.6 pH 6.28 Spec Cond 390 221

Alkalinity 4½ drops H_2SO_4 x 20 = 840 mg/L

GROUNDWATER MONITORING DATA LOG

Well No /Designation MW-17C Date 6-23-98

Site Data

Site Name: Buckeye ESC Personnel. BCB/JSC

Site Address. St Clairsville, OH ESC Project No.: 144195-1

Weather Conditions. Sunny, Hot, & Humid

Well Description

Well Location MW-17C. Toe of Landfill

Well Security Locking Protection

Casing Material: Inner PVC Outer Steel

Well Stick up or Depth Below Ground Surface _____

Organic Vapors (HNu, OVA, TIP) Wellhead 15 ppm

Breathing Zone 0 ppm

Nonaqueous Phase (Thickness and composition) —

Reference Point (i e , top of PVC casing) TPVC

Purge Data

Purge Method Bailing

Note: Allow water level to equilibrate after removing well cap

Total Well Depth (TD). 67.95 ft Depth to Water (DTW). 62.13 ft

Casing Inner Diameter (CID) 2 inches

To calculate well volume Well Vol.(gal) = $(CID)^2 (0\ 041)(TD-DTW)$

Well Volume. 1.0 gal x 3 = Purge Volume 3.0 gal

Purge Time Begin 940 End 1000

Prepurge Data: Temp 19.7 pH 6.36 Spec. Cond 320 ms/cm

Volume 1 Temp 16.7 pH 6.68 Spec Cond 320 313 Turb ≤ 373

Volume 2 Temp 17.1 pH 6.82 Spec Cond 316 >999

Volume 3 Temp 16.6 pH 6.84 Spec Cond 317 >999

Alkalinity 42 drops H_2SO_4 x 20 = 840 mg/L

Appendix B – Summary Table of Groundwater Analytical Results

Table 1

Groundwater Sampling Results
Buckeye Reclamation Landfill
Belmont County Ohio(a)
June 23 24 1998

Compound	P 1B	P 2	P-4	P 22	MW-60 (b)	MW 11B	MW 15C
VOCs (µg/l)							
Chloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromomethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl Chloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methylene Chloride	19 B	7 B	9 B	5 B	7 B	6 B	5 U
Acetone	10 U	10 U	41	10 U	10 U	10 U	10 U
Carbon Disulfide	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1 1 Dichloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1 1 Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
cis 1 2 Dichloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U
trans 1 2 Dichloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromochloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1 2 Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2 Butanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1 1 1 Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Carbon Tetrachloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl Acetate	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromodichloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1 2 Dichloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
cis 1 3 Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1 1 2 Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromoform	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1 2 Dibromo-3-chloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl 2 Pentanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2 Hexanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Tetrachloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1 1 2 2 Tetrachloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Styrene	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Xylene (total)	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1 4-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1 2 Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Iodomethane	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Acrylonitrile	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibromomethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1 2 Dibromomethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1 1 1 2 Tetrachloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1 2 3 Trichloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
trans 1 4-Dichloro-2 butene	40 U	40 U	40 U	40 U	40 U	40 U	40 U
Trichlorofluoromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U

Table 1 (continued)

Groundwater Sampling Results
Buckeye Reclamation Landfill
Belmont County Ohio(a)
June 23 24 1998

Compound	P 1B	P 2	P-4	P 22	MW-60 (b)	MW 11B	MW 15C
PAHs B2EHP (µg/l)							
Naphthalene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2 Methylnaphthalene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Chloronaphthalene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acenaphthylene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acenaphthene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Dibenzofuran	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Fluorene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Phenanthrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Anthracene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Fluoranthene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Pyrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(a)anthracene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chrysene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(b)fluoranthene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(k)fluoranthene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(a)pyrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Indeno(1 2 3-cd)pyrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Dibenzo(a,h)anthracene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(g h ı)perylene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Bis(2-ethylhexyl)phthalate	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Total Metals (ug/l)							
Antimony	2 3 U	2 3 U	2 3 U	2 3 U	? 3 U	2 3 U	2 3 U
Arsenic	8 2 J	2 3 U	25 5	43	52 2	2 3 U	2 3 U
Barium	64 8 J	24 6 J	167 J	87 1 J	104 J	12 8 J	11 4 J
Beryllium	10 3	0 91 U	0 91 U	3 9 J	2 9 J	0 91 U	0 91 U
Cadmium	2 7 U	0 27 U	0 27 U	2 7 U	2 7 U	0 27 U	0 27 U
Calcium	437 000	378 000	428 000	442 000	372 000	366 000	400 000
Chromium	54 5	6 1 U	20 3	71 6	66	6 1 U	6 1 U
Cobalt	111	5 U	105	58 5	60 1	13 9 J	7 7 J
Copper	14 9 J	5 UJ	17 2 J	101 J	104 J	5 UJ	5 UJ
Iron	461 000 J	1 600 J	38 700 J	583 000 J	477 000 J	3 100 J	10 800 J
Lead	5 5	1 7 U	14 7	65 5 J	87	1 7 U	1 7 U
Magnesium	68 500 J	104 000	133 000 J	78 900 J	70 100 J	75 800 J	220 000
Manganese	2950 J	750 J	5470 J	3950 J	3370 J	773 J	386 J
Nickel	433	9 2 J	186	174	167 J	13 3 J	9 2 J
Potassium	17 400	971 J	6 650	14 200	14 500	3 470 J	6370
Selenium	36 U	3 6 U	3 6 U	36 U	36 U	3 6 U	3 6 U
Silver	2 8 U	2 8 U	2 8 U	2 8 U	2 8 U	2 8 U	2 8 U
Sodium	143 000 J	101 000 J	187 000 J	98 800 J	88 500 J	75 000 J	240 000 J
Thallium	6 6 JB	1 7 UJ	7 3 JB	4 8 JB	8 1 JB	2 9 JB	3 7 JB
Vanadium	78	6 2 J	20 J	56 3	68 8	5 3 U	7 8 J
Zinc	2 020 JB	57 2 JB	191 JB	803 JB	744 JB	54 6 JB	111 JB

Table 1 (continued)

Groundwater Sampling Results
Buckeye Reclamation Landfill
Belmont County Ohio(a)
June 23 24 1998

Analyte	P 1B	P 2	P-4	P 22	MW 60 (b)	MW 11B	MW 15C
Dissolved Metals (ug/l)							
Antimony	2 3 U	2 3 U	2 3 U	2 3 U	2 3 U	2 3 U	2 3 U
Arsenic	2 3 U	2 3 U	9 9 J	37 3	34 1	2 3 U	2 3 U
Barium	132 J	196 J	194 J	127 J	77 J	172 J	52 5 J
Beryllium	8 5	0 91 U	0 91 U	1 9 J	1 4 J	0 91 U	0 91 U
Cadmium	2 7 U	0 27 U	0 27 U	2 7 U	2 7 U	0 27 U	0 27 U
Calcium	404 000	423 000	481 000	404 000 J	366 000	311 000 J	446 000
Chromium	46 3	6 1 U	6 1 U	40 7	32 5	6 1 U	6 1 U
Cobalt	102	5 0 U	7 7 J	29 3 J	29 3 J	6 2 J	5 U
Copper	12 9 J	5 0 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ
Iron	478 000	45 JB	24 000	323 000	498 000	1 690	10 500
Lead	6	1 7 U	1 7 U	13 8	6 8 J	1 7 U	3 4 U
Magnesium	60 700 J	120 000 J	164 000	79 300	70 600	70 800	270 000
Manganese	2680	524	6230	3590	3240	668	386
Nickel	399	12 3 J	36 3 J	97 1	88 4	8 8 U	8 8 U
Potassium	15 500	1 050 J	3 180 J	12 200	10 600	3 410 J	7 900
Selenium	36 U	3 6 U	3 6 U	36 U	36 0 U	3 6 U	3 6 U
Silver	2 8 U	2 8 U	2 8 U	2 8 U	2 8 U	2 8 U	3 9 U
Sodium	128 000	125 000	251 000	108 000	95 600	76 300	313 000
Thallium	1 7 U	1 8 JB	1 7 U	1 7 U	? 2 JB	1 9 J	2 5 JB
Vanadium	66	5 9 U	5 3 U	11 4 J	19 9 J	5 3 U	5 3 U
Zinc	2 700 JB	157 JB	195 JB	1160 J	816 JB	744 JB	93 4 JB
Other Analytical Parameters (mg/l)							
Alkalinity	2 U	688	774	2 U	2 U	400	641
Ammonia nitrogen	3 32	0 23	0 94	4 35	4 46	0 49	2 18
Chemical oxygen demand	93 1	5 U	231	137	352	10 6	5 5
Chloride	52	90 1	203	25	24 5	66 4	99 3
Nitrate/Nitrate	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 07
pH (units)	3 56	6 43	6 28	4 71	4 74	6 62	6 37
Specific Conductance (uohm/cm)	3 550	2 940	3 860	3 700	3 690	2 060	4 340
Sulfate	3 960	1 300	1 430	3 360	3 460	972	2 840
Total dissolved solids	5 400	2 760	3 370	4 670	4 660	1 850	4 280
Turbidity (NTU)	34	92	1 750	1 950	2 600	14 2	87

Table 1 (continued)

Groundwater Sampling Results
Buckeye Reclamation Landfill
Belmont County Ohio(a)
June 23 24 1998

Compound	MW 16C	MW 17C	TB062398 (c)	B062498 (d)	FB062398 (e)
VOCs (µg/l)					
Chloromethane	5 U	5 U	5 U	5 U	5 U
Bromomethane	5 U	5 U	5 U	5 U	5 U
Vinyl Chloride	5 U	5 U	5 U	5 U	5 U
Chloroethane	5 U	5 U	5 U	5 U	5 U
Methylene Chloride	6 B	7 B	30 B	23	28 B
Acetone	10 U	10 U	10 U	10 U	10 U
Carbon Disulfide	5 U	5 U	5 U	5 U	5 U
1 1 Dichloroethene	5 U	5 U	5 U	5 U	5 U
1 1 Dichloroethane	5 U	5 U	5 U	5 U	5 U
cis 1 2 Dichloroethene	5 U	5 U	5 U	5 U	5 U
trans 1 2 Dichloroethene	5 U	5 U	5 U	5 U	5 U
Bromochloromethane	5 U	5 U	5 U	5 U	5 U
Chloroform	5 U	5 U	5 U	5 U	5 U
1 2 Dichloroethane	5 U	5 U	5 U	5 U	5 U
2 Butanone	10 U	10 U	10 U	10 U	10 U
1 1 1 Trichloroethane	5 U	5 U	5 U	5 U	5 U
Carbon Tetrachloride	5 U	5 U	5 U	5 U	5 U
Vinyl Acetate	5 U	5 U	5 U	5 U	5 U
Bromodichloromethane	5 U	5 U	5 U	5 U	5 U
1 2 Dichloropropane	5 U	5 U	5 U	5 U	5 U
cis 1 3 Dichloropropene	5 U	5 U	5 U	5 U	5 U
Trichloroethene	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	5 U	5 U	5 U	5 U	5 U
1 1 2 Trichloroethane	5 U	5 U	5 U	5 U	5 U
Benzene	5 U	5 U	5 U	5 U	5 U
Bromoform	5 U	5 U	5 U	5 U	5 U
1 2 Dibromo-3 chloropropane	5 U	5 U	5 U	5 U	5 U
4-Methyl 2 Pentanone	10 U	10 U	10 U	10 U	10 U
2 Hexanone	10 U	10 U	10 U	10 U	10 U
Tetrachloroethene	5 U	5 U	5 U	5 U	5 U
1 1 2 2 Tetrachloroethane	5 U	5 U	5 U	5 U	5 U
Toluene	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	5 U	5 U	5 U	5 U	5 U
Styrene	5 U	5 U	5 U	5 U	5 U
Xylene (total)	5 U	5 U	5 U	5 U	5 U
1 4 Dichlorobenzene	5 U	5 U	5 U	5 U	5 U
1 2 Dichlorobenzene	5 U	5 U	5 U	5 U	5 U
Iodomethane	20 U	20 U	20 U	20 U	20 U
Acrylonitrile	5 U	5 U	5 U	5 U	5 U
Dibromomethane	5 U	5 U	5 U	5 U	5 U
1 2-Dibromomethane	5 U	5 U	5 U	5 U	5 U
1 1 1 2 Tetrachloroethane	5 U	5 U	5 U	5 U	5 U
1 2 3 Trichloropropane	5 U	5 U	5 U	5 U	5 U
trans 1 4-Dichloro-2 butene	40 U	40 U	40 U	40 U	40 U
Trichlorofluoromethane	5 U	5 U	5 U	5 U	5 U

Table 1 (continued)

Groundwater Sampling Results
Buckeye Reclamation Landfill
Belmont County Ohio(a)
June 23 24 1998

Compound	MW 16C	MW 17C	TB062398 (c)	B062498 (d)	FB062398 (e)
PAHs B2EHP (µg/l)					
Naphthalene	10 U	10 U	NA	NA	10 U
2 Methylnaphthalene	10 U	10 U	NA	NA	10 U
2-Chloronaphthalene	10 U	10 U	NA	NA	10 U
Acenaphthylene	10 U	10 U	NA	NA	10 U
Acenaphthene	10 U	10 U	NA	NA	10 U
Dibenzofuran	10 U	10 U	NA	NA	10 U
Fluorene	10 U	10 U	NA	NA	10 U
Phenanthrene	10 U	10 U	NA	NA	10 U
Anthracene	10 U	10 U	NA	NA	10 U
Fluoranthene	10 U	10 U	NA	NA	10 U
Pyrene	10 U	10 U	NA	NA	10 U
Benzo(a)anthracene	10 U	10 U	NA	NA	10 U
Chrysene	10 U	10 U	NA	NA	10 U
Benzo(b)fluoranthene	10 U	10 U	NA	NA	10 U
Benzo(k)fluoranthene	10 U	10 U	NA	NA	10 U
Benzo(a)pyrene	10 U	10 U	NA	NA	10 U
Indeno(1 2 3 cd)pyrene	10 U	10 U	NA	NA	10 U
Dibenzo(a h)anthracene	10 U	10 U	NA	NA	10 U
Benzo(g h i)perylene	10 U	10 U	NA	NA	10 U
Bis(2-ethylhexyl)phthalate	4 J	1 J	NA	NA	10 U
Total Metals (µg/l)					
Antimony	2 3 U	2 3 U	NA	NA	2 3 U
Arsenic	2 3 U	15 5	NA	NA	2 3 U
Barium	35 7 J	488 J	NA	NA	2 9 UJ
Beryllium	0 91 U	1 2 J	NA	NA	0 91 U
Cadmium	0 27 U	0 27 U	NA	NA	0 42 J
Calcium	524 000	89 200	NA	NA	610 J
Chromium	6 1 U	21 8	NA	NA	6 1 U
Cobalt	8 5 J	12 3 J	NA	NA	5 U
Copper	5 UJ	15 6 J	NA	NA	5 U
Iron	8 440 J	13 900 J	NA	NA	14 4 J
Lead	1 7 UJ	25 4	NA	NA	1 7 U
Magnesium	281 000 J	33 100 J	NA	NA	119 UJ
Manganese	306 J	147 J	NA	NA	2 8 J
Nickel	19 9 J	27 1 J	NA	NA	8 8 U
Potassium	7 140	7 950	NA	NA	245
Selenium	3 6 U	6	NA	NA	3 6 U
Silver	2 8 U	2 8 U	NA	NA	2 8 U
Sodium	227 000 J	734 000	NA	NA	339 J
Thallium	3 3 JB	4 2 JB	NA	NA	2 6 J
Vanadium	5 3 U	33 5 J	NA	NA	5 3 U
Zinc	70 9 JB	132 JB	NA	NA	737 J

Table 1 (continued)

Groundwater Sampling Results
Buckeye Reclamation Landfill
Belmont County Ohio(a)
June 23 24 1998

Compound	MW 16C	MW 17C	TB062398 (c)	B062498 (d)	FB062398 (e)
Dissolved Metals (µg/l)					
Antimony	2 3 U	2 3 U	NA	NA	2 3 U
Arsenic	2 3 U	2 3 U	NA	NA	2 3 U
Barium	121 J	255 J	NA	NA	2 9 UJ
Beryllium	0 91 U	0 91 U	NA	NA	0 91 U
Cadmium	0 27 U	0 46 J	NA	NA	0 27 U
Calcium	470 000	82 500	NA	NA	818 J
Chromium	6 1 U	6 1 U	NA	NA	6 1 U
Cobalt	10 8 J	5 U	NA	NA	5 U
Copper	5 UJ	5 UJ	NA	NA	5 UJ
Iron	4 360 J	137 B	NA	NA	273
Lead	3 4 U	1 7 U	NA	NA	1 7 U
Magnesium	260 000	30 500	NA	NA	119 U
Manganese	258	68 2	NA	NA	3 4 J
Nickel	23 J	8 8 U	NA	NA	8 8 U
Potassium	6 640	4 800 J	NA	NA	245 U
Selenium	3 6 U	3 6 U	NA	NA	3 6 U
Silver	2 8 U	3 9 J	NA	NA	2 8 U
Sodium	219 000	711 000	NA	NA	436 J
Thallium	2 4 J	2 2 J	NA	NA	3 3 J
Vanadium	5 3 U	5 3 U	NA	NA	5 3 U
Zinc	185 JB	351 JB	NA	NA	156 J
Other Analytical Parameters (mg/l)					
Alkalinity	758	820	NA	NA	3
Ammonia nitrogen	1 54	0 62	NA	NA	0 1 U
Chemical oxygen demand	35 5	10 6	NA	NA	5 U
Chloride	101	66 8	NA	NA	1 U
Nitrate/Nitrate	0 05 U	0 81	NA	NA	0 13
pH (units)	6 45	7 18	NA	NA	5 68
Specific Conductance (uohm/cm)	4 120	3 610	NA	NA	5 U
Sulfate	2 740	1 350	NA	NA	5 U
Total dissolved solids	4 370	2 790	NA	NA	13 8
Turbidity (NTU)	88 5	220	NA	NA	0 2 U

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a/ U=undetected J=estimated concentration NA=not analyzed B=probable blank contamination
b/ duplicate of P 22
c/ trip blank sent with samples 6/23/98
d/ trip blank sent with samples 6/24/98
e/ equipment blank collected 6/24/98

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Appendix C – Quality Assurance/Quality Control Report

ENVIRONMENTAL STRATEGIES CORPORATION

Four Penn Center West Suite 315 Pittsburgh Pennsylvania 15276 (412) 787 5100 Fax (412) 787-8065

DATA VALIDATION SUMMARY REPORT
1998 INTERIM GROUNDWATER MONITORING
BUCKEYE RECLAMATION LANDFILL
BELMONT COUNTY, OHIO

PREPARED

BY

ENVIRONMENTAL STRATEGIES CORPORATION

OCTOBER 7, 1998

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Introduction

This data validation review includes analytical data from nine groundwater samples and associated field and laboratory quality control (QC) samples collected by Environmental Strategies Corporation (ESC) at the Buckeye Reclamation Landfill site in Belmont County Ohio on June 23 and 24 1998 The samples were analyzed by Ceimic Corporation Narragansett, Rhode Island for volatile organic compounds (VOCs) polycyclic aromatic hydrocarbons (PAHs) and bis-(2-ethylhexyl)phthalate (B2EHP) total and dissolved metals and the inorganic parameters alkalinity ammonia nitrogen chemical oxygen demand chloride nitrate nitrite pH specific conductance sulfate total dissolved solids and turbidity in accordance with Ohio EPA Solid Waste Regulations 3745-27-10 and regulatory agency requests The VOCs PAHs and B2EHP were analyzed using U S Environmental Protection Agency (EPA) Contract Laboratory Program (CLP) Statement of Work (SOW) for Organics OLM01 9 The metals were analyzed by EPA CLP SOW for inorganics ILM03 0 The inorganic perameters were analyzed by EPA Methods SM 2320B 350 1 410 4 9056 9056 9056 150 1 120 1 9056 160 1 and 180 1 respectively

This report presents a discussion of the data quality for each fraction (i e VOCs PAHs and B2EHP metals and inorganics) The qualified analytical data are presented in Table 1 The QC data are presented in Tables A-1 through A-7 and the data qualifier definitions are presented in Attachments A and B Field QC and overall assessment of the analytical data are discussed in separate sections of this report

A summary of the individual samples and the analyses conducted is presented in Table A-1

The analytical data were validated and qualified according to the EPA CLP National Functional Guidelines for Organic Data Review (EPA-540/R-94/012 February 1994) the EPA CLP National Functional Guidelines for Inorganic Data Review (EPA-540/R-94/013 February 1994) EPA Region V Standard Operating Procedure for Validation of CLP Organic Data (August 1993) and method specific criteria

The VOC PAHs and B2EHP data were reviewed for holding times from date of sample collection surrogate recoveries, MS/MSD method equipment and trip blanks (VOCs only)

instrument performance (GC/MS tune) initial and continuing calibration internal standard performance chromatographic and mass spectral raw data field duplicates and overall assessment of the VOC and PAH/B2EHP data

The metals data were reviewed for holding times from date of sample collection calibration blanks interference check sample (ICS) laboratory control sample (LCS) matrix spike laboratory duplicate post digestion spike recovery ICP serial dilution preparation and analysis logs CRDLs instrument raw data field duplicate and overall assessment of the inorganic data

The inorganic parameters were reviewed for holding times from data of sample collection, calibration blanks LCS MS/MSD laboratory duplicate preparation and analysis logs detection limits instrument raw data field duplicate and overall assessment of the inorganic data

VOCs

All samples were analyzed within the required method holding times Holding times are presented in Table A-2 Methylene chloride was detected in the laboratory blank corresponding to samples FB062398 MB 11B MW-16C MW-17C MW-60 and P-22 Positive results for this compound in these samples were considered undetected as probable blank contamination (B) Laboratory blank contamination is presented in Table A-4 Methylene chloride was detected in the equipment blank (FB062398) and both trip blanks (TB062398 and TB062498) Positive results for methylene chloride in the corresponding samples were considered undetected as probable blank contamination (B) Equipment and trip blank contamination are presented in Table A-5 All other QC criteria including surrogate recoveries matrix spike/matrix spike duplicate recoveries and precision GC/MS tune initial and continuing calibration internal standard performance, chromatographic and mass spectral raw data were within acceptable limits

PAHs and B2EHP

The samples were extracted and analyzed within the required method holding times Holding times are presented in Table A 2 The matrix spike (MS) recoveries for 4-nitrophenol and pentachlorophenol were outside of recommended QC limits The matrix spike duplicate (MSD) could not be measured because of loss of sample in the laboratory No action was taken on the data because data are not qualified on MS/MSD results alone All other QC criteria including surrogate recoveries method and equipment blanks instrument performance (GC/MS tune) initial and continuing calibration internal standard performance chromatographic and mass spectral raw data were within acceptable limits

Total and Dissolved Metals

The dissolved metals were field filtered through a 0 45µm filter The samples were prepared and analyzed within the required method holding times Holding times are presented in Table A-2 The MS recoveries for total and dissolved barium and copper were outside of QC limits A post digestion spike was run that was within acceptable QC limits for total and dissolved copper but outside of QC limits for total and dissolved zinc This indicates that the MS was out of limits due to matrix interference The relative percent difference (RPD) between the laboratory duplicate pair was outside of QC limits for total and dissolved zinc ICP serial dilutions were outside of QC limits for total iron, magnesium manganese sodium and thallium Results for these analytes were considered estimated concentrations (J/UJ) Matrix spike laboratory duplicates and ICP serial dilutions outside of QC limits are presented in table A-6 Total cadmium calcium iron manganese potassium, sodium thallium zinc dissolved calcium iron, manganese sodium thallium and zinc were detected in the equipment blank at low levels Results for these analytes in the corresponding samples were considered undetected as probable blank contamination if the concentration in the sample was less the five time the concentration of the level in the blank All other QC criteria including calibration, blanks ICS LCS preparation and analysis logs CRDLs instrument raw data were within acceptable QC limits

Inorganic Analytes

All samples were analyzed within the required method holding times Holding times are presented in Table A-2 Alkalinity and total dissolved solids (TDS) were detected in the equipment blank No action was taken on the data because the alkalinity in the corresponding samples was greater than five times the level in the blank All QC criteria including calibration blanks LCS MS/MSD laboratory duplicate preparation and analysis logs detection limits and instrument raw data were within acceptable limits

Field Quality Control

Two trip blanks were analyzed for VOCs to assess cross contamination during sample transit from the field to the laboratory Methylene chloride was detected in both trip blanks Results for methylene chloride were considered undetected as probable blank contamination

One equipment blank (FB062398) was collected for the same parameters as the samples to assess the efficiency of the decontamination process Several analytes were detected in the equipment blank The corresponding sample results for these analytes were qualified as undetected probable blank contamination (UB) if the concentration in the sample was less than five times (10 times for methylene chloride) the concentration in the blank Equipment blank contamination is presented in Table A-5

One blind field duplicate was collected with these samples MW-60 was a blind field duplicate of P-22 Analytes detected in both samples and the calculated RPDs are presented on table A-7

RPDs of 30 or less indicate excellent field and laboratory precision and a homogeneous sample matrix RPDs greater than 30 are common when the analytes are detected near or below the contract required defection limit This is the case with the total and dissolved metals from this sampling event Some inorganic parameters including chemical oxygen demand often display wide ranges in precision

Overall Assessment of the Data

All samples were analyzed within the required method holding times Methylene chloride which is a common laboratory contaminant was detected in the equipment and trip blanks Several metals at trace levels were also detected in the equipment blank The effect on

the data was discussed above Matrix spike recoveries laboratory duplicate precision and ICP serial dilutions were outside of QC limits for several metals therefore results in the corresponding samples were considered estimated Based on the above review the data with qualification are of acceptable quality and usable for the purpose of assessing groundwater contamination at the Buckeye Reclamation Landfill site

Table 1

Groundwater Sampling Results
Buckeye Reclamation Landfill
Belmont County Ohio(a)
June 23 24 1998

Compound	P 1B	P 2	P 4	P 22	MW-60 (b)	MW 11B	MW 15C
VOCs (µg/l)							
Chloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromomethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl Chloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methylene Chloride	19 B	7 B	9 B	5 B	7 B	6 B	5 U
Acetone	10 U	10 U	41	10 U	10 U	10 U	10 U
Carbon Disulfide	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1 1 Dichloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1 1 Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
cis 1 2 Dichloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U
trans-1 2 Dichloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromochloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1 2 Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2 Butanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1 1 1 Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Carbon Tetrachloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl Acetate	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromodichloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1 2 Dichloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
cis 1 3 Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1 1 2 Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromoform	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1 2 Dibromo-3-chloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl 2 Pentanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2 Hexanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Tetrachloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1 1 2 2 Tetrachloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Styrene	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Xylene (total)	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1 4-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1 2 Dichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Iodomethane	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Acrylonitrile	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibromomethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1 2 Dibromomethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1 1 1 2 Tetrachloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1 2 3 Trichloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
trans 1 4-Dichloro-2 butene	40 U	40 U	40 U	40 U	40 U	40 U	40 U
Trichlorofluoromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U

Table 1 (continued)

Groundwater Sampling Results
Buckeye Reclamation Landfill
Belmont County Ohio(a)
June 23 24 1998

Compound	P 1B	P 2	P 4	P 22	MW-60 (b)	MW 11B	MW 15C
PAHs B2EHP (µg/l)							
Naphthalene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2 Methylnaphthalene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Chloronaphthalene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acenaphthylene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acenaphthene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Dibenzofuran	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Fluorene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Phenanthrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Anthracene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Fluoranthene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Pyrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(a)anthracene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chrysene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(b)fluoranthene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(k)fluoranthene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(a)pyrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Indeno(1 2 3 cd)pyrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Dibenzo(a h)anthracene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(g h i)perylene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Bis(2-ethylhexyl)phthalate	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Total Metals (ug/l)							
Antimony	2 3 U	2 3 U	2 3 U	2 3 U	2 3 U	2 3 U	2 3 U
Arsenic	8 2 J	2 3 U	25 5	43	52 2	2 3 U	2 3 U
Barium	64 8 J	24 6 J	167 J	87 1 J	104 J	12 8 J	11 4 J
Beryllium	10 3	0 91 U	0 91 U	3 9 J	2 9 J	0 91 U	0 91 U
Cadmium	2 7 U	0 27 U	0 27 U	2 7 U	2 7 U	0 27 U	0 27 U
Calcium	437 000	378 000	428 000	442 000	372 000	366 000	400 000
Chromium	54 5	6 1 U	20 3	71 6	66	6 1 U	6 1 U
Cobalt	111	5 U	105	58 5	60 1	13 9 J	7 7 J
Copper	14 9 J	5 UJ	17 2 J	101 J	104 J	5 UJ	5 UJ
Iron	461 000 J	1 600 J	38 700 J	583 000 J	477 000 J	3 100 J	10 800 J
Lead	5 5	1 7 U	14 7	65 5 J	87	1 7 U	1 7 U
Magnesium	68 500 J	104 000	133 000 J	78 900 J	70 100 J	75 800 J	220 000
Manganese	2950 J	750 J	5470 J	3950 J	3370 J	773 J	386 J
Nickel	433	9 2 J	186	174	167 J	13 3 J	9 2 J
Potassium	17 400	971 J	6 650	14 200	14 500	3 470 J	6370
Selenium	36 U	3 6 U	3 6 U	36 U	36 U	3 6 U	3 6 U
Silver	2 8 U	2 8 U	2 8 U	2 8 U	2 8 U	2 8 U	2 8 U
Sodium	143 000 J	101 000 J	187 000 J	98 800 J	88 500 J	75 000 J	240 000 J
Thallium	6 6 JB	1 7 UJ	7 3 JB	4 8 JB	8 1 JB	2 9 JB	3 7 JB
Vanadium	78	6 2 J	20 J	56 3	68 8	5 3 U	7 8 J
Zinc	2 020 JB	57 2 JB	191 JB	803 JB	744 JB	54 6 JB	111 JB

Table 1 (continued)

Groundwater Sampling Results
Buckeye Reclamation Landfill
Belmont County Ohio(a)
June 23 24 1998

Analyte	P 1B	P 2	P-4	P 22	MW-60 (b)	MW 11B	MW 15C
Dissolved Metals (ug/l)							
Antimony	2 3 U	2 3 U	2 3 U	2 3 U	2 3 U	2 3 U	2 3 U
Arsenic	2 3 U	2 3 U	9 9 J	37 3	34 1	2 3 U	2 3 U
Barium	132 J	196 J	194 J	127 J	77 J	172 J	52 5 J
Beryllium	8 5	0 91 U	0 91 U	1 9 J	1 4 J	0 91 U	0 91 U
Cadmium	2 7 U	0 27 U	0 27 U	2 7 U	2 7 U	0 27 U	0 27 U
Calcium	404 000	423 000	481 000	404 000 J	366 000	311 000 J	446 000
Chromium	46 3	6 1 U	6 1 U	40 7	32 5	6 1 U	6 1 U
Cobalt	102	5 0 U	7 7 J	29 3 J	29 3 J	6 2 J	5 U
Copper	12 9 J	5 0 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ
Iron	478 000	45 JB	24 000	323 000	498 000	1 690	10 500
Lead	6	1 7 U	1 7 U	13 8	6 8 J	1 7 U	3 4 U
Magnesium	60 700 J	120 000 J	164 000	79 300	70 600	70 800	270 000
Manganese	2680	524	6230	3590	3240	668	386
Nickel	399	12 3 J	36 3 J	97 1	88 4	8 8 U	8 8 U
Potassium	15 500	1 050 J	3 180 J	12 200	10 600	3 410 J	7 900
Selenium	36 U	3 6 U	3 6 U	36 U	36 0 U	3 6 U	3 6 U
Silver	2 8 U	2 8 U	2 8 U	2 8 U	2 8 U	2 8 U	3 9 U
Sodium	128 000	125 000	251 000	108 000	95 600	76 300	313 000
Thallium	1 7 U	1 8 JB	1 7 U	1 7 U	2 2 JB	1 9 J	2 5 JB
Vanadium	66	5 9 U	5 3 U	11 4 J	19 9 J	5 3 U	5 3 U
Zinc	2 700 JB	157 JB	195 JB	1160 J	816 JB	744 JB	93 4 JB
Other Analytical Parameters (mg/l)							
Alkalinity	2 U	688	774	2 U	2 U	400	641
Ammonia nitrogen	3 32	0 23	0 94	4 35	4 46	0 49	2 18
Chemical oxygen demand	93 1	5 U	231	137	352	10 6	5 5
Chloride	52	90 1	203	25	24 5	66 4	99 3
Nitrate/Nitrate	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 05 U	0 07
pH (units)	3 56	6 43	6 28	4 71	4 74	6 62	6 37
Specific Conductance (uohm/cm)	3 550	2 940	3 860	3 700	3 690	2 060	4 340
Sulfate	3 960	1 300	1 430	3 360	3 460	972	2 840
Total dissolved solids	5 400	2 760	3 370	4 670	4 660	1 850	4 280
Turbidity (NTU)	34	92	1 750	1 950	2 600	14 2	87

Table 1 (continued)

Groundwater Sampling Results
Buckeye Reclamation Landfill
Belmont County Ohio(a)
June 23 24 1998

Compound	MW 16C	MW 17C	TB062398 (c)	B062498 (d)	FB062398 (e)
VOCs (µg/l)					
Chloromethane	5 U	5 U	5 U	5 U	5 U
Bromomethane	5 U	5 U	5 U	5 U	5 U
Vinyl Chloride	5 U	5 U	5 U	5 U	5 U
Chloroethane	5 U	5 U	5 U	5 U	5 U
Methylene Chloride	6 B	7 B	30 B	23	28 B
Acetone	10 U	10 U	10 U	10 U	10 U
Carbon Disulfide	5 U	5 U	5 U	5 U	5 U
1 1 Dichloroethene	5 U	5 U	5 U	5 U	5 U
1 1 Dichloroethane	5 U	5 U	5 U	5 U	5 U
cis 1 2 Dichloroethene	5 U	5 U	5 U	5 U	5 U
trans 1 2 Dichloroethene	5 U	5 U	5 U	5 U	5 U
Bromochloromethane	5 U	5 U	5 U	5 U	5 U
Chloroform	5 U	5 U	5 U	5 U	5 U
1 2 Dichloroethane	5 U	5 U	5 U	5 U	5 U
2 Butanone	10 U	10 U	10 U	10 U	10 U
1 1 1 Trichloroethane	5 U	5 U	5 U	5 U	5 U
Carbon Tetrachloride	5 U	5 U	5 U	5 U	5 U
Vinyl Acetate	5 U	5 U	5 U	5 U	5 U
Bromodichloromethane	5 U	5 U	5 U	5 U	5 U
1 2 Dichloropropane	5 U	5 U	5 U	5 U	5 U
cis 1 3 Dichloropropene	5 U	5 U	5 U	5 U	5 U
Trichloroethene	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	5 U	5 U	5 U	5 U	5 U
1 1 2 Trichloroethane	5 U	5 U	5 U	5 U	5 U
Benzene	5 U	5 U	5 U	5 U	5 U
Bromoform	5 U	5 U	5 U	5 U	5 U
1 2 Dibromo-3 chloropropane	5 U	5 U	5 U	5 U	5 U
4-Methyl 2 Pentanone	10 U	10 U	10 U	10 U	10 U
2 Hexanone	10 U	10 U	10 U	10 U	10 U
Tetrachloroethene	5 U	5 U	5 U	5 U	5 U
1 1 2 2 Tetrachloroethane	5 U	5 U	5 U	5 U	5 U
Toluene	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	5 U	5 U	5 U	5 U	5 U
Styrene	5 U	5 U	5 U	5 U	5 U
Xylene (total)	5 U	5 U	5 U	5 U	5 U
1 4-Dichlorobenzene	5 U	5 U	5 U	5 U	5 U
1 2 Dichlorobenzene	5 U	5 U	5 U	5 U	5 U
Iodomethane	20 U	20 U	20 U	20 U	20 U
Acrylonitrile	5 U	5 U	5 U	5 U	5 U
Dibromomethane	5 U	5 U	5 U	5 U	5 U
1 2 Dibromomethane	5 U	5 U	5 U	5 U	5 U
1 1 1 2 Tetrachloroethane	5 U	5 U	5 U	5 U	5 U
1 2 3-Trichloropropane	5 U	5 U	5 U	5 U	5 U
trans-1 4-Dichloro-2 butene	40 U	40 U	40 U	40 U	40 U
Trichlorofluoromethane	5 U	5 U	5 U	5 U	5 U

Table 1 (continued)

Groundwater Sampling Results
Buckeye Reclamation Landfill
Belmont County Ohio(a)
June 23 24 1998

Compound	MW 16C	MW 17C	TB062398 (c)	B062498 (d)	FB062398 (e)
PAHs B2EHP (µg/l)					
Naphthalene	10 U	10 U	NA	NA	10 U
2 Methylnaphthalene	10 U	10 U	NA	NA	10 U
2-Chloronaphthalene	10 U	10 U	NA	NA	10 U
Acenaphthylene	10 U	10 U	NA	NA	10 U
Acenaphthene	10 U	10 U	NA	NA	10 U
Dibenzofuran	10 U	10 U	NA	NA	10 U
Fluorene	10 U	10 U	NA	NA	10 U
Phenanthrene	10 U	10 U	NA	NA	10 U
Anthracene	10 U	10 U	NA	NA	10 U
Fluoranthene	10 U	10 U	NA	NA	10 U
Pyrene	10 U	10 U	NA	NA	10 U
Benzo(a)anthracene	10 U	10 U	NA	NA	10 U
Chrysene	10 U	10 U	NA	NA	10 U
Benzo(b)fluoranthene	10 U	10 U	NA	NA	10 U
Benzo(k)fluoranthene	10 U	10 U	NA	NA	10 U
Benzo(a)pyrene	10 U	10 U	NA	NA	10 U
Indeno(1 2 3 cd)pyrene	10 U	10 U	NA	NA	10 U
Dibenzo(a h)anthracene	10 U	10 U	NA	NA	10 U
Benzo(g h i)perylene	10 U	10 U	NA	NA	10 U
Bis(2-ethylhexyl)phthalate	4 J	1 J	NA	NA	10 U
Total Metals (µg/l)					
Antimony	2 3 U	2 3 U	NA	NA	2 3 U
Arsenic	2 3 U	15 5	NA	NA	2 3 U
Barium	35 7 J	488 J	NA	NA	2 9 UJ
Beryllium	0 91 U	1 2 J	NA	NA	0 91 U
Cadmium	0 27 U	0 27 U	NA	NA	0 42 J
Calcium	524 000	89 200	NA	NA	610 J
Chromium	6 1 U	21 8	NA	NA	6 1 U
Cobalt	8 5 J	12 3 J	NA	NA	5 U
Copper	5 UJ	15 6 J	NA	NA	5 U
Iron	8 440 J	13 900 J	NA	NA	14 4 J
Lead	1 7 UJ	25 4	NA	NA	1 7 U
Magnesium	281 000 J	33 100 J	NA	NA	119 UJ
Manganese	306 J	147 J	NA	NA	2 8 J
Nickel	19 9 J	27 1 J	NA	NA	8 8 U
Potassium	7 140	7 950	NA	NA	245
Selenium	3 6 U	6	NA	NA	3 6 U
Silver	2 8 U	2 8 U	NA	NA	2 8 U
Sodium	227 000 J	734 000	NA	NA	339 J
Thallium	3 3 JB	4 2 JB	NA	NA	2 6 J
Vanadium	5 3 U	33 5 J	NA	NA	5 3 U
Zinc	70 9 JB	132 JB	NA	NA	737 J

Table 1 (continued)

Groundwater Sampling Results
Buckeye Reclamation Landfill
Belmont County Ohio(a)
June 23 24 1998

Compound	MW 16C	MW 17C	TB062398 (c)	B062498 (d)	FB062398 (e)
Dissolved Metals (µg/l)					
Antimony	2 3 U	2 3 U	NA	NA	2 3 U
Arsenic	2 3 U	2 3 U	NA	NA	2 3 U
Barium	121 J	255 J	NA	NA	2 9 UJ
Beryllium	0 91 U	0 91 U	NA	NA	0 91 U
Cadmium	0 27 U	0 46 J	NA	NA	0 27 U
Calcium	470 000	82 500	NA	NA	818 J
Chromium	6 1 U	6 1 U	NA	NA	6 1 U
Cobalt	10 8 J	5 U	NA	NA	5 U
Copper	5 UJ	5 UJ	NA	NA	5 UJ
Iron	4 360 J	137 B	NA	NA	273
Lead	3 4 U	1 7 U	NA	NA	1 7 U
Magnesium	260 000	30 500	NA	NA	119 U
Manganese	258	68 2	NA	NA	3 4 J
Nickel	23 J	8 8 U	NA	NA	8 8 U
Potassium	6 640	4 800 J	NA	NA	245 U
Selenium	3 6 U	3 6 U	NA	NA	3 6 U
Silver	2 8 U	3 9 J	NA	NA	2 8 U
Sodium	219 000	711 000	NA	NA	436 J
Thallium	2 4 J	2 2 J	NA	NA	3 3 J
Vanadium	5 3 U	5 3 U	NA	NA	5 3 U
Zinc	185 JB	351 JB	NA	NA	156 J
Other Analytical Parameters (mg/l)					
Alkalinity	758	820	NA	NA	3
Ammonia nitrogen	1 54	0 62	NA	NA	0 1 U
Chemical oxygen demand	35 5	10 6	NA	NA	5 U
Chloride	101	66 8	NA	NA	1 U
Nitrate/Nitrate	0 05 U	0 81	NA	NA	0 13
pH (units)	6 45	7 18	NA	NA	5 68
Specific Conductance (uohm/cm)	4 120	3 610	NA	NA	5 U
Sulfate	2 740	1 350	NA	NA	5 U
Total dissolved solids	4 370	2 790	NA	NA	13 8
Turbidity (NTU)	88 5	220	NA	NA	0 2 U

a/ U=undetected J=estimated concentration NA=not analyzed B=probable blank contamination
b/ duplicate of P 22
c/ trip blank sent with samples 6/23/98
d/ trip blank sent with samples 6/24/98
e/ equipment blank collected 6/24/98

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Table A 1

Samples Collected
Buckeye Reclamation Site Landfill
Belmont County, Ohio
June 23 24, 1998

Sample	Date Collected	Matrix	Fraction
P 1B	06/23/98	water	VOCs PAHs&B2EHP TMet DMet NH4 COD Alk TDS NO3 SO4 Cl pH Turb Sp Cond
P-22	06/23/98	water	VOCs PAHs&B2EHP TMet DMet NH4 COD Alk TDS NO3 SO4 Cl pH Turb Sp Cond
MW 11B	06/23/98	water	VOCs PAHs&B2EHP TMet DMet,NH4 COD Alk TDS NO3 SO4 Cl pH Turb Sp Cond
MW 16C	06/23/98	water	VOCs PAHs&B2EHP TMet DMet NH4 COD Alk TDS NO3 SO4 Cl pH Turb Sp Cond
MW 17C	06/23/98	water	VOCs PAHs&B2EHP TMet DMet,NH4 COD Alk TDS NO3 SO4 Cl pH Turb Sp Cond
MW 60	06/23/98	water	VOCs PAHs&B2EHP TMet DMet NH4 COD Alk TDS NO3 SO4 Cl pH Turb Sp Cond
FB062398	06/23/98	water	VOCs PAHs&B2EHP TMet DMet NH4 COD Alk TDS NO3 SO4 Cl pH Turb Sp Cond
TB062398	06/23/98	water	VOCs
P 2	06/24/98	water	VOCs PAHs&B2EHP TMet DMet,NH4 COD Alk TDS NO3 SO4 Cl pH Turb Sp Cond
P-4	06/24/98	water	VOCs PAHs&B2EHP TMet DMet NH4 COD Alk TDS NO3 SO4 Cl pH Turb Sp Cond
MW 15C	06/24/98	water	VOCs PAHs&B2EHP TMet DMet NH4 COD Alk TDS NO3 SO4 Cl pH Turb Sp Cond
TB062498	06/24/98	water	VOCs

Table A 2

Analytical Holding Times for Samples Collected at the
Buckeye Reclamation Landfill
Belmont County, Ohio
June 1998

VOCS

Sample	Date Collected	Matrix	Date Analyzed	No of Days to Analyze	Holding Time (days)
P 1B	06/23/98	Water	07/02/98	9	14
P 22	06/23/98	Water	07/02/98	9	14
MW 11B	06/23/98	Water	07/01/98	8	14
MW 16C	06/23/98	Water	07/01/98	8	14
MW 17C	06/23/98	Water	07/01/98	8	14
MW 60	06/23/98	Water	07/01/98	8	14
FB062398	06/23/98	Water	07/01/98	8	14
TB062398	06/23/98	Water	07/02/98	9	14
P 2	06/24/98	Water	07/02/98	8	14
P 4	06/24/98	Water	07/02/98	8	14
MW 15C	06/24/98	Water	07/02/98	8	14
TB062498	06/24/98	Water	07/02/98	8	14

PAHs, B2EHP

Sample	Date Collected	Date Extracted	Date Analyzed	Days to Extract	Days to Analyze	Holding Time (days)
P 1B	06/23/98	06/29/98	07/03/98	6	4	7 to extr /40 to analysis
P 22	06/23/98	06/29/98	07/04/98	6	5	7 to extr./40 to analysis
MW 11B	06/23/98	06/29/98	07/04/98	6	5	7 to extr /40 to analysis
MW 16C	06/23/98	06/29/98	07/04/98	6	5	7 to extr./40 to analysis
MW 17C	06/23/98	06/29/98	07/06/98	6	7	7 to extr /40 to analysis
MW-60	06/23/98	06/29/98	07/06/98	6	7	7 to extr /40 to analysis
FB062398	06/23/98	06/29/98	07/06/98	6	7	7 to extr./40 to analysis
TB062398	06/23/98	NA	NA	NA	NA	7 to extr /40 to analysis
P 2	06/24/98	06/29/98	07/08/98	5	9	7 to extr /40 to analysis
P 4	06/24/98	06/29/98	07/06/98	5	7	7 to extr /40 to analysis
MW 15C	06/24/98	06/29/98	07/07/98	5	8	7 to extr /40 to analysis
TB062498	06/24/98	NA	NA	NA	NA	7 to extr /40 to analysis

Table A 2 (continued)

Analytical Holding Times for Samples Collected at the
Buckeye Reclamation Landfill
Belmont County, Ohio
June 1998

Total and Dissolved Metals

Sample	Date Collected	Date Metals Analyzed	Days to Analyze	Holding Time (days)
P 1B	06/23/98	07/30/98	37	180
P 22	06/23/98	07/30/98	37	180
MW 11B	06/23/98	07/30/98	37	180
MW 16C	06/23/98	07/30/98	37	180
MW 17C	06/23/98	07/30/98	37	180
MW 60	06/23/98	07/30/98	37	180
FB062398	06/23/98	07/30/98	37	180
TB062398	06/23/98	N/A	N/A	180
P 2	06/24/98	07/30/98	36	180
P 4	06/24/98	07/30/98	36	180
MW 15C	06/24/98	07/30/98	36	180
TB062498	06/24/98	N/A	N/A	180

Alkalinity

Sample	Date Collected	Date Analyzed	Days to Analyze	Holding Time (days)
P-1B	06/23/98	06/30/98	7	14 days
P 22	06/23/98	06/30/98	7	14 days
MW 11B	06/23/98	06/30/98	7	14 days
MW 16C	06/23/98	06/30/98	7	14 days
MW 17C	06/23/98	06/30/98	7	14 days
MW 60	06/23/98	06/30/98	7	14 days
FB062398	06/23/98	06/30/98	7	14 days
TB062398	06/23/98	NA	NA	14 days
P 2	06/24/98	06/30/98	6	14 days
P-4	06/24/98	06/30/98	6	14 days
MW 15C	06/24/98	06/30/98	6	14 days
TB062498	06/24/98	NA	NA	14 days

Table A 2 (continued)

Analytical Holding Times for Samples Collected at the
Buckeye Reclamation Landfill
Belmont County, Ohio
June 1998

Ammonia

Sample	Date Collected	Date Analyzed	Days to Analyze	Holding Time (days)
P 1B	06/23/98	07/15/98	22	28 Days
P 22	06/23/98	07/15/98	22	28 Days
MW 11B	06/23/98	07/15/98	22	28 Days
MW 16C	06/23/98	07/15/98	22	28 Days
MW 17C	06/23/98	07/15/98	22	28 Days
MW 60	06/23/98	07/15/98	22	28 Days
FB062398	06/23/98	07/15/98	22	28 Days
TB062398	06/23/98	NA	NA	28 Days
P 2	06/24/98	07/15/98	21	28 Days
P 4	06/24/98	07/15/98	NA	28 Days
MW 15C	06/24/98	07/15/98	21	28 Days
TB062498	06/24/98	NA	NA	28 Days

COD

Sample	Date Collected	Date Analyzed	Days to Analyze	Holding Time (days)
P 1B	06/23/98	07/17/98	24	28 Days
P 22	06/23/98	07/17/98	24	28 Days
MW 11B	06/23/98	07/17/98	24	28 Days
MW 16C	06/23/98	07/17/98	24	28 Days
MW-17C	06/23/98	07/17/98	24	28 Days
MW 60	06/23/98	07/17/98	24	28 Days
FB062398	06/23/98	07/17/98	24	28 Days
TB062398	06/23/98	NA	NA	28 Days
P 2	06/24/98	07/17/98	23	28 Days
P-4	06/24/98	07/17/98	23	28 Days
MW 15C	06/24/98	07/17/98	23	28 Days
TB062498	06/24/98	NA	NA	28 Days

Table A 2 (continued)

Analytical Holding Times for Samples Collected at the
Buckeye Reclamation Landfill
Belmont County, Ohio
June 1998

Chloride

Sample	Date Collected	Date Analyzed	Days to Analyze	Holding Time (days)
P 1B	06/23/98	06/29/98	6	28 Days
P 22	06/23/98	06/29/98	6	28 Days
MW 11B	06/23/98	06/29/98	6	28 Days
MW 16C	06/23/98	06/29/98	6	28 Days
MW 17C	06/23/98	06/29/98	6	28 Days
MW 60	06/23/98	06/29/98	6	28 Days
FB062398	06/23/98	06/29/98	6	28 Days
TB062398	06/23/98	NA	NA	28 Days
P 2	06/24/98	06/29/98	5	28 Days
P 4	06/24/98	06/29/98	5	28 Days
MW 15C	06/24/98	06/29/98	5	28 Days
TB062498	06/24/98	NA	NA	28 Days

Nitrate/Nitrite

Sample	Date Collected	Date Analyzed	Days to Analyze	Holding Time (days)
P 1B	06/23/98	07/07/98	14	28 Days
P 22	06/23/98	07/07/98	14	28 Days
MW 11B	06/23/98	07/07/98	14	28 Days
MW 16C	06/23/98	07/07/98	14	28 Days
MW 17C	06/23/98	07/07/98	14	28 Days
MW 60	06/23/98	07/07/98	14	28 Days
FB062398	06/23/98	07/07/98	14	28 Days
TB062398	06/23/98	NA	NA	28 Days
P 2	06/24/98	07/07/98	13	28 Days
P 4	06/24/98	07/07/98	13	28 Days
MW 15C	06/24/98	07/07/98	13	28 Days
TB062498	06/24/98	NA	NA	28 Days

Table A 2 (continued)

Analytical Holding Times for Samples Collected at the
Buckeye Reclamation Landfill
Belmont County, Ohio
June 1998

pH

Sample	Date Collected	Date Analyzed	Days to Analyze	Holding Time (days)
P 1B	06/23/98	06/24/98	1	1 Day
P 22	06/23/98	06/24/98	1	1 Day
MW 11B	06/23/98	06/24/98	1	1 Day
MW 16C	06/23/98	06/24/98	1	1 Day
MW 17C	06/23/98	06/24/98	1	1 Day
MW 60	06/23/98	06/24/98	1	1 Day
FB062398	06/23/98	06/24/98	1	1 Day
TB062398	06/23/98	NA	NA	1 Day
P 2	06/24/98	06/25/98	1	1 Day
P-4	06/24/98	06/25/98	1	1 Day
MW 15C	06/24/98	06/25/98	1	1 Day
TB062498	06/24/98	NA	NA	1 Day

Specific Conductance

Sample	Date Collected	Date Analyzed	Days to Analyze	Holding Time (days)
P 1B	06/23/98	07/06/98	13	28 Days
P 22	06/23/98	07/06/98	13	28 Days
MW 11B	06/23/98	07/06/98	13	28 Days
MW 16C	06/23/98	07/06/98	13	28 Days
MW 17C	06/23/98	07/06/98	13	28 Days
MW 60	06/23/98	07/06/98	13	28 Days
FB062398	06/23/98	07/06/98	13	28 Days
TB062398	06/23/98	NA	NA	28 Days
P 2	06/24/98	07/06/98	12	28 Days
P 4	06/24/98	07/06/98	12	28 Days
MW 15C	06/24/98	07/06/98	12	28 Days
TB062498	06/24/98	NA	NA	28 Days

Table A 2 (continued)

Analytical Holding Times for Samples Collected at the Buckeye Reclamation Landfill Belmont County, Ohio June 1998

Sulfate

Sample	Date Collected	Date Analyzed	Days to Analyze	Holding Time (days)
P 1B	06/23/98	07/02/98	9	28 Days
P 22	06/23/98	07/02/98	9	28 Days
MW 11B	06/23/98	07/02/98	9	28 Days
MW 16C	06/23/98	07/02/98	9	28 Days
MW 17C	06/23/98	07/02/98	9	28 Days
MW 60	06/23/98	07/02/98	9	28 Days
FB062398	06/23/98	07/02/98	9	28 Days
TB062398	06/23/98	NA	NA	28 Days
P 2	06/24/98	07/02/98	8	28 Days
P 4	06/24/98	07/02/98	8	28 Days
MW 15C	06/24/98	07/02/98	8	28 Days
TB062498	06/24/98	NA	NA	28 Days

TDS

Sample	Date Collected	Date Analyzed	Days to Analyze	Holding Time (days)
P 1B	06/23/98	06/26/98	3	7 Days
P 22	06/23/98	06/26/98	3	7 Days
MW 11B	06/23/98	06/26/98	3	7 Days
MW 16C	06/23/98	06/26/98	3	7 Days
MW 17C	06/23/98	06/26/98	3	7 Days
MW-60	06/23/98	06/26/98	3	7 Days
FB062398	06/23/98	06/26/98	3	7 Days
TB062398	06/23/98	NA	NA	7 Days
P 2	06/24/98	06/26/98	2	7 Days
P-4	06/24/98	06/26/98	2	7 Days
MW 15C	06/24/98	06/26/98	2	7 Days
TB062498	06/24/98	NA	NA	7 Days

Table A 2 (continued)

Analytical Holding Times for Samples Collected at the
Buckeye Reclamation Landfill
Belmont County, Ohio
June 1998

Turbidity

Sample	Date Collected	Date Analyzed	Days to Analyze	Holding Time (days)
P 1B	06/23/98	06/24/98	1	2 Days
P 22	06/23/98	06/24/98	1	2 Days
MW 11B	06/23/98	06/24/98	1	2 Days
MW 16C	06/23/98	06/24/98	1	2 Days
MW 17C	06/23/98	06/24/98	1	2 Days
MW 60	06/23/98	06/24/98	1	2 Days
FB062398	06/23/98	06/24/98	1	2 Days
TB062398	06/23/98	NA	NA	2 Days
P 2	06/24/98	06/25/98	1	2 Days
P-4	06/24/98	06/25/98	1	2 Days
MW 15C	06/24/98	06/25/98	1	2 Days
TB062498	06/24/98	NA	NA	2 Days

Table A 3

Matrix Spike/Matrix Spike Duplicate Results for Organics Analyses
Outside of Recommended QC Limits
Buckeye Reclamation Landfill
Belmont County, Ohio
June 1998 (a)

SVOCs

Spiked Sample **MW 15C**

Compound	MS % Rec	MSD % Rec	MS/MSD QC Limits	% RPD	% RPD QC Limits
4 Nitrophenol	102 *	0 (b)	10 80	200 (a)	50
Pentachlorophenol	106 *	0 (b)	9 103	200 (a)	50

a/ MS = matrix spike MSD = matrix spike duplicate RPD = relative percent difference
% Rec = percent recovery

b/ Matrix spike duplicate sample extract lost in the laboratory results unavailable

Table A-4

Laboratory Blank Contamination
Buckeye Reclamation Landfill
Belmont County, Ohio
June 1998

Blank	Compound	Concentration (µg/l)	Associated Samples
VBLKFI	Methylene chloride	7 0	FB062398 MB 11B MW 16C MW 17C MW-60 P 22

Table A 5

Equipment Blank Contamination
Buckeye Reclamation Landfill
Belmont County, Ohio
June 23 24, 1998

Blank	Compound	Concentration (µg/l)	Associated Samples
FB062398	Methylene chloride	28 0 J	all
	Total Cadmium	0 42 J	
	Total Calcium	610 J	
	Total Iron	14	
	Total Manganese	2 8 J	
	Total Potasium	245 0 J	
	Total Sodium	339 J	
	Total Thallium	2 6 J	
	Total Zinc	737 J	
	Dissolved Calcium	818 J	
	Dissolved Iron	273	
	Dissolved Manganese	3 4 J	
	Dissolved Sodium	436 J	
	Dissolved Thallium	3 3 J	
	Dissolved Zinc	156 0	
	Alkalinity	3 0	
	TDS	13 8	
TB062398	Methylene chloride	30	P 1B P 22 MW 11B MW 16C MW 17C MW 60 FB062398
TB062498	Methylene chloride	23	P 2 P-4 MW 15C

Table A 6

Matrix Spike Recoveries, Laboratory Duplicate Precision and ICP Serial Dilutions for Metals Outside QC Limits
Buckeye Reclamation Landfill
Belmont County, Ohio
June 1998 (a)

Spiked Sample **MW 15C**

Analyte	MS % Rec	Post Digestion Spike Recovery	QC Limits
Total Barium	65 4 *	99 5	85 115
Total Copper	67 9 *	0 *	85 115
Dissolved Barium	73 8 *	97 9	85 115
Dissolved Copper	72 8 *	0 *	85 115

Laboratory Duplicates

Duplicate Sample **MW 15C**

Analyte	RPD	QC Limit
Total Zinc	125 7 *	20
Dissolved Zinc	23 1 *	20

ICP Serial Dilutions

Analyte	%D	QC Limit
Total Iron	30 5 *	10
Total Magnesium	18 7 *	10
Total Manganese	58 1 *	10
Total Sodium	21 3 *	10
Thallium	100 *	10

a/ MS = matrix spike RPD = relative percent difference %D = percent difference ICP = inductively coupled plasma spectrograph
* = outside of QC limits

Table A 7

Field Duplicate Analysis
Groundwater Sampling Results
Buckeye Reclamation Landfill
Belmont County, Ohio(a)
June 23 24, 1998

Compound	P 22	MW 60 (b)	RPDs
VOCs (µg/l)			
Methylene Chloride	5 B	7 B	33 3%
Total Metals (ug/l)			
Arsenic	43	52 2	19 3%
Barium	87 1 J	104 J	17 7%
Beryllium	3 7 J	2 9 J	24 2%
Calcium	442 000	372 000	17 2%
Chromium	71 6	66	8 1%
Cobalt	58 5	60 1	2 7%
Copper	101 J	104 J	2 9%
Iron	583 000 J	477 000	20 0%
Lead	65 5 J	87	28 2%
Magnesium	78 900 J	70 900 J	10 7%
Manganese	3 950	3 370 J	15 8%
Nickel	174	167 J	4 1%
Potassium	14 200	14 500	2 1%
Selenium	36 U	36 U	0 0%
Silver	2 8 U	2 8 U	0 0%
Sodium	98 800 J	88 500 J	11 0%
Thallium	4 8 J	8 1 J	51 2%
Vanadium	56 3	68 8	20 0%
Zinc	803 J	744 J	7 6%
Dissolved Metals (ug/l)			
Arsenic	37 3	34 1	9 0%
Barium	127 J	77 J	49 0%
Beryllium	1 9 J	1 4 J	30 3%
Cadmium	2 7 U	2 7 U	0 0%
Calcium	404 000 J	366 000	9 9%
Chromium	40 7	32 5	22 4%
Cobalt	29 3 J	29 3 J	0 0%
Iron	323 000	498 000	42 6%
Lead	13 8	6 8 J	68 0%
Magnesium	79 300	70 600	11 6%
Manganese	3 590	3 240	10 2%
Nickel	97 1	88 4	9 4%
Potassium	12 200	10 600	14 0%
Sodium	108 000	95 600	12 2%
Thallium	1 7 U	2 2 J	25 6%
Vanadium	11 4 J	19 9 J	54 3%
Zinc	1 160	816 J	34 8%
Other Analytical Parameters (mg/l)			
Ammonia nitrogen	4 35	4 46	2 5%
Chemical oxygen demand	137	352	87 9%
Chloride	25	24 5	2 0%
pH (units)	4 71	4 74	0 6%
Specific Conductance (uohm/c)	3 700	3 690	0 3%

Table A 7 (continued)

Field Duplicate Analysis
Groundwater Sampling Results
Buckeye Reclamation Landfill
Belmont County, Ohio(a)

Other Analytical Parameters (mg/l)			
Sulfate	3 360	3 460	2 9%
Total dissolved solids	4 670	4 660	0 2%
Turbidity (NTU)	1 950	2 600	28 6%

a/ U = undetected J = estimated concentration RPD = relative percent difference
b/ Duplicate of P 22

docs/144195/fd0698 xls

Attachment A - Data Qualifier Definitions for Inorganic Data Review

U — The analyte was analyzed for but not detected above the level of the associated value The associated value is the Instrument Detection Limit (IDL) for all analytes except Cyanide (CN) and Mercury (Hg) For CN and Hg the associated value is the Contract Required Detection Limit (CRDL)

J — The analyte was analyzed for and was positively identified but the associated numerical value may not be consistent with the amount actually present in the environmental sample

One or more of the following quality control criteria were not met

- Blank contamination indicates possible high bias and/or false positives
- Calibration range exceeded indicates possible low bias and/or false negatives
- Holding times not met indicates possible low bias and/or false negatives
- Other QC outside control limits bias not readily determined

UJ — A combination of the U and "J" qualifier The analyte was analyzed for but was not detected above the level of the associated value The associated value may not accurately or precisely represent the sample detection limit

UB — The result is considered undetected because of probable blank contamination

Reference — U S EPA CLP Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analysis (February 1994)

Attachment B Data Qualifier Definitions for Organic Data Review

The following definitions provide a brief explanation of the national qualifiers assigned to results in the data review process

U The analyte was analyzed for but was not detected above the reported sample quantitation limit

J The analyte was positively identified the associated numerical value is the approximate concentration of the analyte in the sample

UJ The analyte was not detected above the reported sample quantitation limit However the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample

UB The result is considered undetected because of probable blank contamination

Reference U S EPA CLP National Functional Guidelines for Organic Data Review (February 1994)